MODEL AIRPLANE NEWS

FIRST LOOK! SAITO 100 TWIN

THE WORLD'S PREMIER R/C MODELING MAGAZINE

August 1994

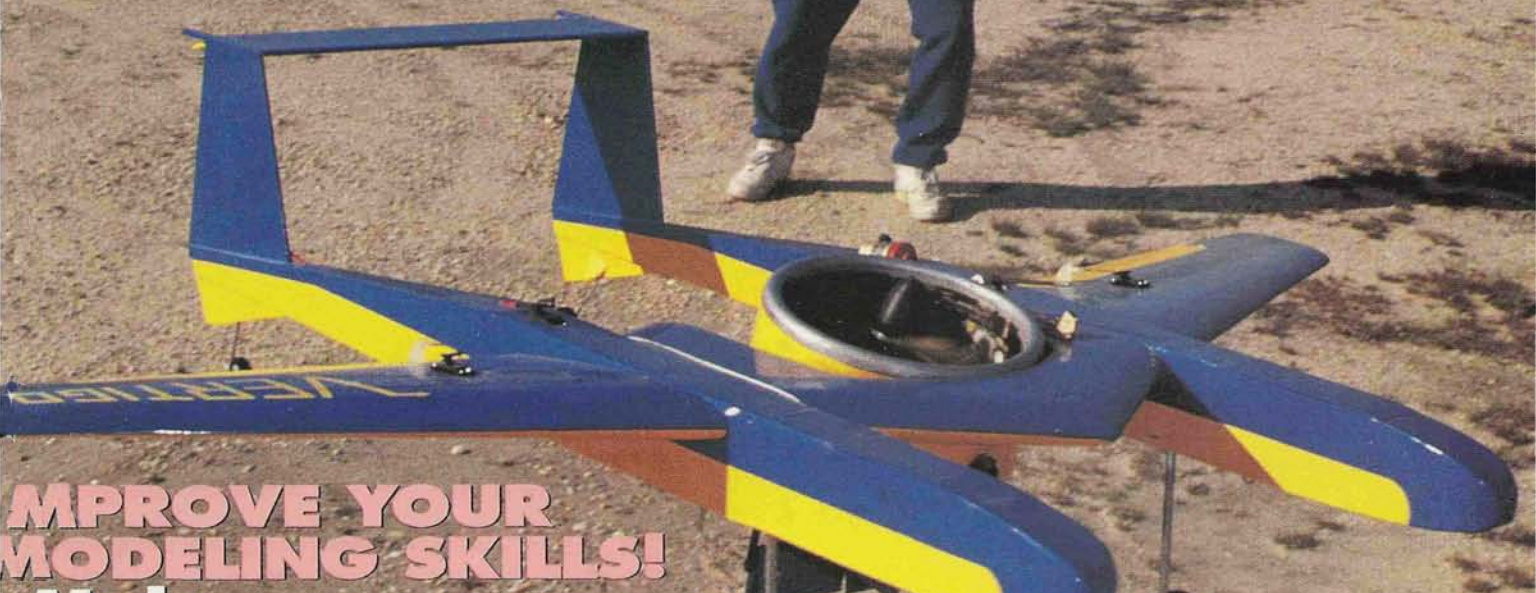
48120

Vertical-takeoff breakthrough!

VERTIGO

Build this history-making design

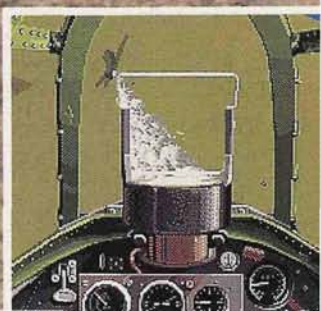
KEEP COOL! Ducting for cowled engines



MPROVE YOUR MODELING SKILLS!

- Make your own graphics
- Perfect the tailslide
- Build foam floats
- Make scale fillets

GEnie's Air Warrior: ON-LINE fighter squadron



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REVIEWED IN THIS ISSUE

- JR Propo XF622
- Direct Connection F-20 Tigershark
- Flair Products Legionaire
- EZ Baccara

AUGUST 1994 VOLUME 122, NUMBER 8

MODEL AIRPLANE NEWS

FEATURES

ABOVE: *Tom Hunt's Vertigo—the first R/C vertical takeoff and landing (VTOL) sport aircraft in history—crawls forward into the wind.* **Photo by Don Abramson**

ON THE COVER: *Tom Hunt hovers the latest version of his Vertigo design. The subject of a two-part construction article, the Vertigo can take off vertically, fly horizontally and then transition back to a hover for a vertical landing. Tom notes that the performance of the version shown on the cover (extended twin booms) is identical to that of the design described in the construction article (forward central pod). Will you be the first in your club to build and fly one of these aircraft? Photo by Walter Sidas.*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

Model Airplane News (ISSN 0026-7295) is published monthly by **Air Age, Inc.,** 251 Danbury Rd., Wilton, CT 06897. Second-class postage paid at Wilton, CT, and at additional mailing offices. Subscription rates: $27.95 for 1 year (Canada, $43.82—includes G.S.T.; foreign, $40.95); $49.95 for 2 years (Canada, $81.27—includes G.S.T.; foreign, $75.95). **Postmaster:** send Form 3597 to **Model Airplane News,** P.O. Box 428, Mount Morris, IL 61054.

EDITORIAL

TOM ATWOOD

TOP GUN '94 WINNERS

Top Gun '94, cosponsored by *Model Airplane News*, Pacer Technology and Frank Tiano Enterprises (and further supported by a large number of contributing sponsors), was once again an inspiring celebration of the best of scale modeling. For the fourth year, the beautiful, well-manicured, deep-green polo fields at the West Palm Beach Polo Club in south Florida fairly glittered from the shining presence of more than 50 competing, precision-scale planes in Expert and Team categories. After a week of downpours, the skies cleared and perfect weather—blue skies punctuated by puffy cumulous clouds, with temperatures in the low 70s—greeted the dozens of contestants from the U.S. and abroad. There were many tens of eye-catching entries, including the first propane-fueled turbine jet to compete in scale competition on this continent.

Dino Digiorgio (pilot) and Bob Pickney (builder), who won first place in Team with their impressive Twin Beech D-18.

Our thanks to Pacer, Frank Tiano Enterprises and all the contributing sponsors for their support, and our congratulations to Terry Nitsch, who took first place in Expert with his beautiful BVM F-86F Sabre, and to Dino Digiorgio (pilot) and Bob Pickney (builder), who won first place in Team with their impressive Twin Beech D-18. There were many other winners in a variety of categories and beautiful engineering and artistic scale masterpieces that would wow the most experienced modelers. Next issue, we'll have a full report.

DESIGN CONTEST UPDATE

The combined summary of contest rules is complete and available. At some point, the rules must be deemed final, of course, despite the stream of interesting queries that continue to arrive from all over the globe. A few queries received over the Internet from overseas modelers were lost because of a computer glitch. If you posted a question and did not receive an answer, please let us know, and we will promptly reply.

We've been seeking a way to publicize this contest in Russia. If any of our readers have connections there that could facilitate the involvement of Russian modelers, please contact me at the address noted at the end of this editorial. A few more late-breaking points

Terry Nitsch, who took first place in Expert with his impressive BVM F-86F Sabre, shares the limelight with his wife and pit-crew member, Sheila.

can be made on the design-contest rules. The rule that the swept area (disk area) of fixed downward-thrusting rotors should not exceed 60 percent of the combined area of those rotors and wing (and/or lifting body) area *does* apply to fixed rotors mounted outside the wing. The calculation of wing area is based on the primary (main) wing and does not include stabilizer area. It does, however, include the disk area of fixed downward thrusting rotors. Sponsors are allowed. If you have further questions, contact Julie Soriano at the address noted below. We look forward to the widest participation!

THE VERTIGO—R/C HISTORY

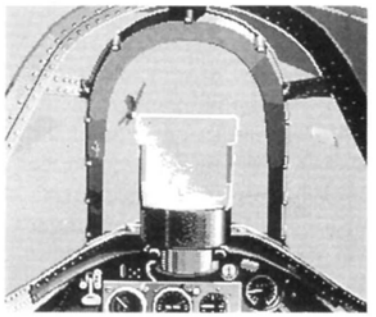
This month, we feature the first of a two-part series on the construction of Tom Hunt's Vertigo. This is a vertical take-off and landing (VTOL) R/C aircraft, i.e., it can take off and land like a helicopter as well as transition in the air to and from traditional horizontal flight. This design owes much to years of VTOL model development at Grumman Aerospace. Personalities who contributed significantly to that work and whose names are well-known in the R/C industry include Bob Kress, Nick Ziroli, John Gorham and, of course, Tom Hunt. We're pleased to present you with this epochal design and will continue to strive to bring you the very best projects and coverage on the leading edge of our great sport.

VIRTUAL MODELING IS HERE

You'll notice an article of a different nature in this issue—on the Kesmai Air Warrior flight simulator that runs on the GEnie on-line service. Is this modeling?—certainly not R/C modeling, but we felt it would be of interest to many of our readers. Air Warrior is a significant development in cyberspace aviation, and most people with a genuine interest in airplanes will want to take note. The Air Warrior flight simulator

models WW II aircraft with exacting adherence to the performance of the actual full-scale aircraft. For example, in the ultra-realistic on-line mode, the simulated aircraft demonstrate the same stall and spin characteristics of the planes after which they're modeled.

Real players—people in front of their PC screens—fly all the



planes. You can choose from dozens of fighters. Two bomber simulators—one for B-17s and one for A26s—include multiple crew members (pilot, navigator, bombardier and up to six gunners). If you're a tail gunner shooting at oncoming German or Japanese fighters, you can experience the thrill of knowing that there are other players, sitting at their PCs, flying the oncoming fighters. This is a form of aviation combat simulation that goes beyond arcade or stand-alone PC-flight simulators. You're essentially watching a color war movie in which you participate. A flight-training course is available on-line, and international squadrons are forming to recreate actual WW II battles. Take a look at David Garwood's article, and let us know whether you liked it (or other features in this issue). Write, fax, or e-mail to Tom Atwood, c/o *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897; fax (203) 762-9803; Internet address: toma@airage.com. ■

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MODEL AIRPLANE NEWS (ISSN 0026-7295, USPS 533-470) is published monthly by Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897. Connecticut. Editorial and Business Offices, 251 Danbury Rd., Wilton, CT 06897. Phone: 203-834-2900. FAX: 203-762-9803. Michael F. Doyle, Chief Executive Officer; Y.P. Johnson, President; G.E. DeFrancesco, Vice President; L.V. DeFrancesco, Secretary; Yvonne M. DeFrancesco, Treasurer. Second Class Postage Permit paid at Wilton, Connecticut, and additional Mailing Offices.

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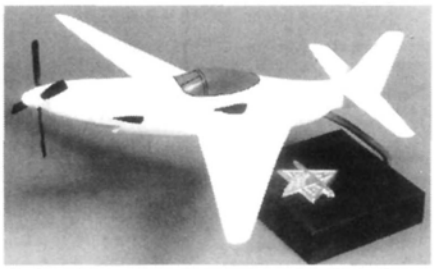
AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News**, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

SWEEPING QUESTION

The photo with this letter is of a proposed North American Aviation P-51 with forward-swept wings. The project dates to the mid to late '40s. I was informed by the company that they did extensive investigations of this form; if they could have built wings that would have held together, it would have greatly improved the conventional Mustangs.



Had advanced composite materials been available, the famous P-51 might have looked like this.

I'm trying to gather information on this concept for some articles. I've been told that an artist named Chuck Davis published a three-view in *Aeroplane* magazine. I expect that there were wind-tunnel studies, descriptions, sketches and other data available at the time of the project.

I'd like to hear from anyone who can provide or direct me to information. I'll be happy to share all information I get with those who help. Together, we should be able to assemble a bit of really obscure—but interesting—history. My thanks to Rocky Ruckdaschel of North American Rockwell for giving me the original photo and the lead on the three-view!

LARRY RENGER
13182 Sutton St.
Cerritos, CA 90701

YAW-PITCH COUPLING

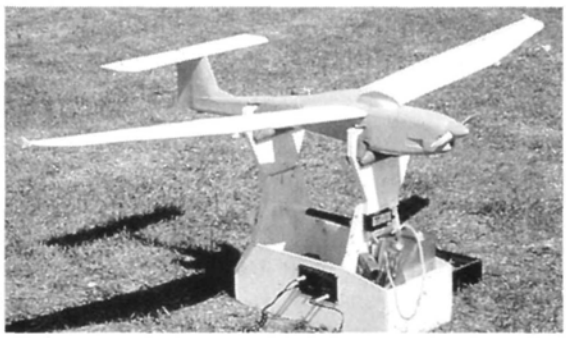
I'm responding to the "Yaw-Pitch Coupling Question" from the February '94 "Airwaves." Mr. Lennon was very observant and, I believe, fairly accurate in his conclusion that fuselage-induced turbulence can cause a yaw-pitch coupling, i.e., deflecting the rudder causes the model to pitch up or down.

Although it's generally accepted that dihedral (either too much or not enough) is the reason for roll coupling with rudder, I've never heard a conclusive explanation of what causes pitch coupling. Most pattern fliers will agree that moving the horizontal stab up or down will cure pitch coupling. If the plane pitches down, move the stab down; if it pitches up, move the stab up. This is a case of "We know how to fix it; we just don't know why it happens."

My theory is that when the fuselage is presented to the airflow with an angle of attack (such as in knife-edge flight), the air will flow around the fuselage from one side to the other. At some point, turbulence will develop on one side of the fuselage; this will affect one side of the horizontal stab. I also believe that on the other side of the fuselage, a line of separation occurs, i.e., some air flows over the top and some over the bottom. If the stab isn't close to where the air separates, there will be some pitch coupling. The fact that moving the stab up or down on the fuselage fixes the problem seems to support this theory.

One aim of a pattern flier is to end up with a plane that is "pure" in yaw. With today's computer radios, a lot of guys will use the electronic mixers to correct any roll or pitch coupling in their planes. After all, it's a lot easier to punch a few buttons than to cut up the airplane.

I flew a Great Planes Cap 21 in pattern during the '91 and '92 seasons. As you may know, the Cap 21's stab is all the way up on top of the fuselage. It also had a strong tendency to pitch down with application of rudder, so much so that it



The Dove motor-glider design by Andy Lennon.

would do a complete knife-edge circle with nothing but rudder input. After I had added more than 30 percent mix from rudder to elevator, it would do a straight knife-edge.

I hope this information is useful. I don't know if my explanation is the right one or not. Maybe someone who has access to a wind tunnel can try it out.

ROBERT D. RICHARDS, JR.
[City of origin unavailable]

IN REPLY

Mr. Richards, thank you for a very interesting response to the "Yaw-Pitch Coupling Question." Your theory is very compelling.

The low horizontal tail settings on many pattern planes bring them into, or close to, the wing's wake and into the fuselage boundary layer; both factors reduce their effectiveness.

To compensate, tail-moment arms are long, and tail areas are large.

To me, it makes sense to:

- Slenderize the fuselage aft of the wing.
- Position the horizontal tail as far away from the wing and fuselage (vertically) as possible.

A T-tail is the obvious answer. In the last year, experience with three T-tailed airplanes confirms this. Two—the Tomahawk and the Swift—were covered in the February '94 "Airwaves." The third is a .15 glow-powered glider, roughly the size of the Swift. It has a 6-degree dihedral and is controlled by rudder and elevator; it has no ailerons. It turns beautifully on rudder only, with no yaw-pitch coupling. This model is illustrated in the attached photo and is called the "Dove." The tail-moment arm is three times the wing's mean aerodynamic chord, and the horizontal tail's area is 18 percent of the wing's area.

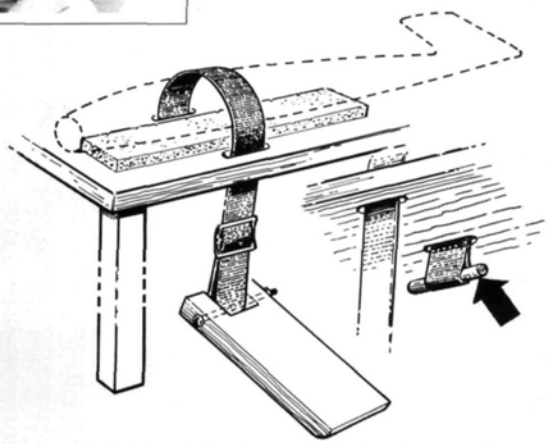
ANDY LENNON
Quebec, Canada

■

HINTS & KINKS

JIM NEWMAN

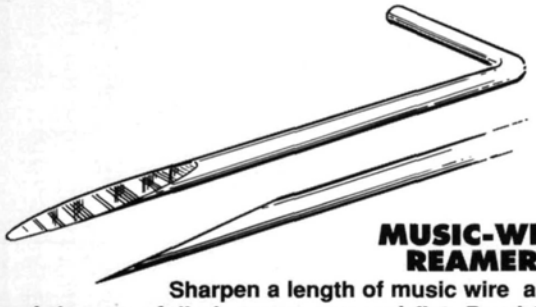
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



HANDS-FREE HOLD-DOWN

To hold awkwardly shaped items such as fuselages securely for two-handed working, try this. Make two slots in your workbench, and run a webbing strap through them as shown. The strap is held at the bench end by a dowel (arrowed) and on the floor by a block you hold with one foot. A foam pad cushions the piece you're working on.

Dennis Bryant, Burgess Hill, Sussex, England

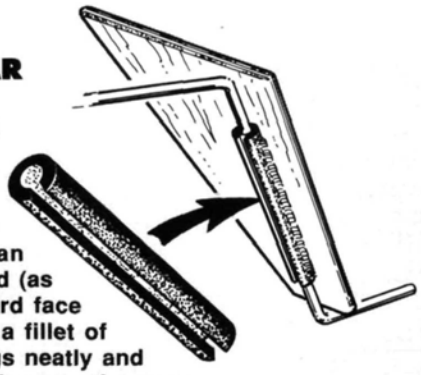


MUSIC-WIRE REAMERS

Sharpen a length of music wire as shown, and then carefully hammer one end flat. Bend the other end to make a handle, and use your wire tool to ream out soft metal or plastic wheel bearings, etc. Make several tools, using music wire of different diameters.

Eric Marsden, Horndean, Hampshire, England

LANDING-GEAR FAIRINGS



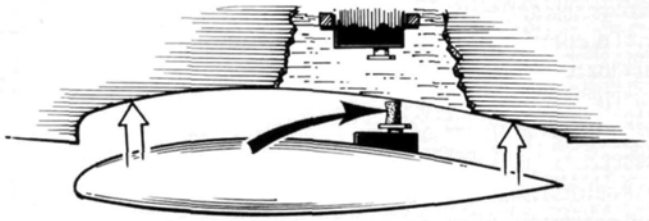
Instead of holding the fairings on the landing gear with a rubber band, glue 5/16-inch-o.d. car vacuum hose with an 1/8-inch strip removed (as shown) to the inboard face of each fairing with a fillet of PFM. Clip the fairings neatly and very inconspicuously onto the gear wire. This tip is particularly effective on the Goldberg Cub.

Don Pushee, Salem, NY

STARTING SAFETY BRIDLE

Avoid having a runaway model that can cause injury. Bind a loop into each end of a soft nylon rope, and cover the middle with plastic shrink-sleeve to protect the model's finish. Run the cord around the rear fuselage as shown, then drop the loops over a tent spike to hold your model while you start it. To taxi away, just lift one loop off the spike.

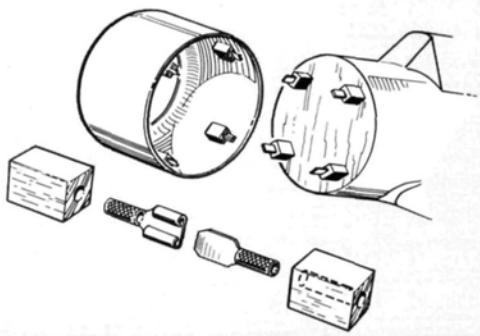
Scott Rickenbacker, Enterprise, AL



CLAY CLEARANCE GAUGE

To determine how much clearance there is between components such as a fuselage and the wing servos, put a little pillar of modeling clay on top of the lower servo, then attach the wing. The clay will be compressed, and when you remove the wing, the clay will show how much clearance there is. If you hold the servos temporarily with double-stick tape, you'll be able to reposition them easily (no redundant screw holes). Screws should be used for final retaining, of course!

Emile Alline, Lynnwood, WA



SOLDER-LUG COWL RETAINERS

Large solder lugs glued into wooden blocks that are, in turn, glued to the firewall and inside the cowl, will nicely hold the cowl—no ugly screws!

Gregory Reid, College Park, GA

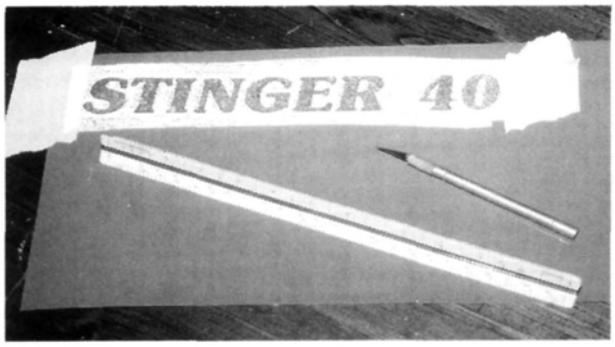
HOW TO

Cut Custom Graphics

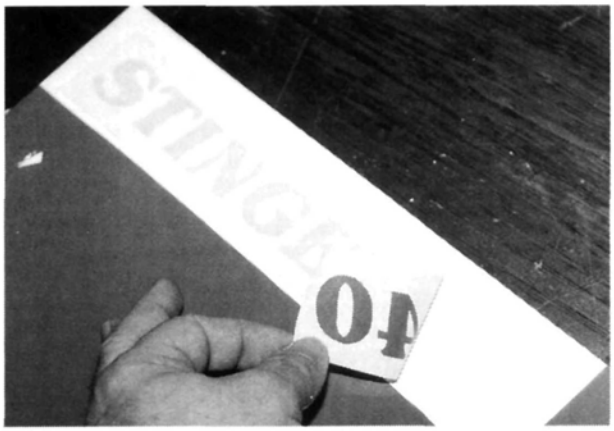
by GERRY YARRISH

You'll need trim sheet material of various colors (I use Coverite Graphics trim sheet), a sharp hobby knife, 2-inch-wide masking tape, a straightedge and a copy of the graphic you want to reproduce.*

CUSTOM GRAPHICS WILL set your model apart from the rest. Here's an easy way to make your own decals out of inexpensive color trim sheets and apply them to your model. Whether you're using magazine titles, model names, or personalized logos, this technique is quick and simple, and best of all, the results are fun to show off at the flying field.



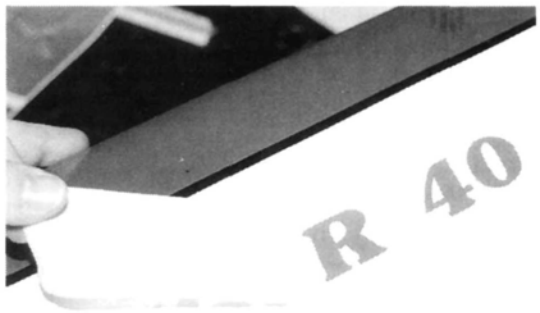
1 *Start by choosing a design: the name of the model, a logo, etc. Use a copy machine to enlarge the image to the size you want, and make multiple copies of it—one for each color in the graphic. Cut out the graphic, and tape it onto the trim material. Then cut through the paper copy and the trim material, but not through the trim material's paper backing. For letters such as O, P, B, D, etc., cut out the centers before you cut around the outsides. Use a straightedge to cut the straight lines, and then cut the curved parts freehand.*



2 *Remove the material from around the cut letters. (Professional sign makers call this "weeding.") This makes it easy to see where letters might need more trimming. De-tack the 2-inch-wide masking tape by pressing it against your clothing before you apply it. Carefully remove it, and then place it over the letters, and burnish it down. Slowly remove the letters from the backing paper. Be careful not to let the letters' adhesive sides touch each other.*

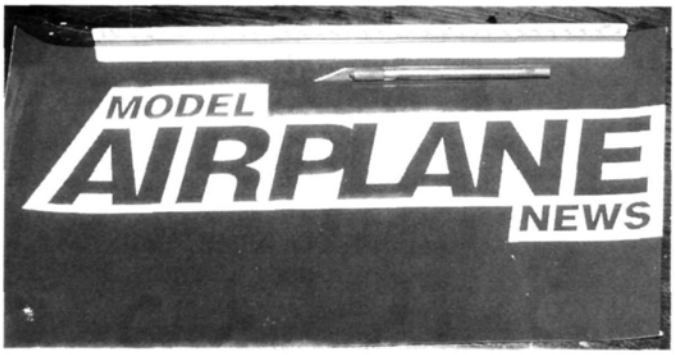
PHOTOS BY GERRY YARRISH

3 *Position the letters on your model, and press them into place. Starting at one end and working toward the other, burnish only the letters into place. (A pen or a plastic prop will make a good burnishing tool.) Try not to burnish the tape itself onto the model because it will make it difficult to remove the masking.*



4 *Remove the masking, and then rub the letters down again. If air bubbles are trapped under them, make small cuts in the letters to let the air escape. (I've found that Coverite Graphics trim sheet material "breathes," and any small air bubbles tend to disappear over time.) Don't use a pin to make a hole in the letters because you might pierce your model's covering, and this will allow fuel residue to get under your covering material.*

Unique stick-on decals Simple and fun



5 *For multicolor graphics, the technique is similar; cut out and weed the first color (red in the photo).*

6 *Apply that color to a second backing color and burnish the letters down, removing as many air bubbles as possible.*

7 *Weed the unwanted backing color, and lift the composite decal with de-tacked masking tape as described before. This is an easy way to make markings such as the U.S. "bar-n-star" insignia, the German Maltese cross, squadron insignias, etc.*

8 *Apply the multicolor decal to your model as described above, but be very careful not to lift the decal's top layer. Once it's in place, burnish down the finished graphic, and set your model in the sun for about an hour to let the adhesive cure.*

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

■

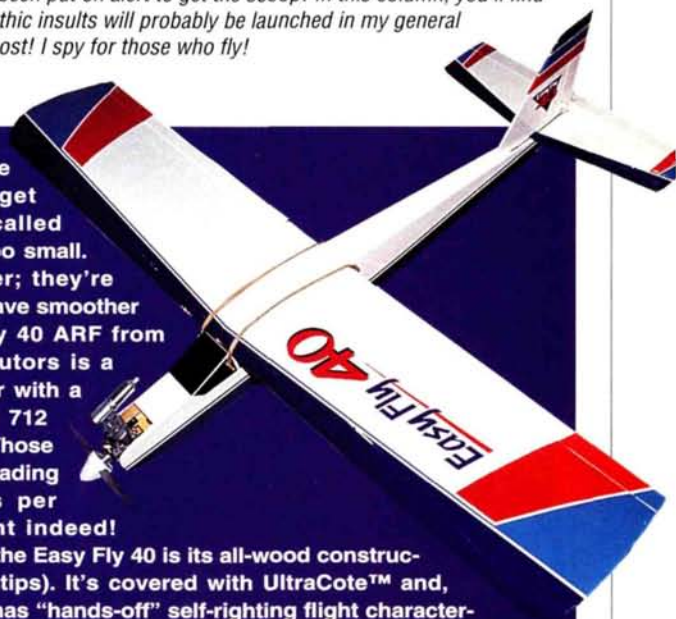
AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Why is Jerry Smiling?

Jerry Nelson of Nelson Aircraft is very proud of his new System Three Resins. These nonflammable, low-odor and low-toxicity, *water-based,* polyurethane paints are also low in volatile organic compounds; this makes them safe for indoor use. Developed for the marine, automotive and full-scale aircraft industries by System Three, these paints can be brushed or sprayed on, and they dry dust-free in 5 minutes! Water is used as a thinner and for cleanup. The dried paint is fuelproof and can be applied directly to polyester fabrics—without the need for clear dope. The paints are available in 40 colors (including 17 military) and in two-part epoxy primer for rigid surfaces. I know why Jerry is smiling; he's going to sell a whole lot of this stuff! For free information, contact Nelson Aircraft Co., 21550 N.W. Nicholas Ct., Unit D, Hillsboro, OR 97124; (503) 629-5277; fax (503) 628-5817.

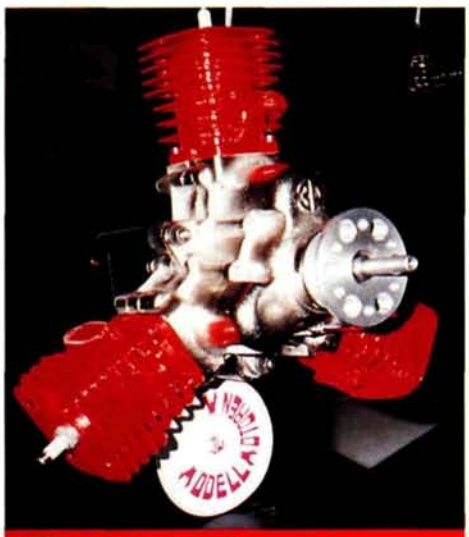


Too many times, I've seen a beginner get discouraged by a so-called "trainer" that was just too small. Bigger planes fly better; they're much more stable and have smoother response. The Easy Fly 40 ARF from Horizon Hobby Distributors is a 4¾- to 5½-pound trainer with a 64¾-inch wingspan and 712 square inches of area. Those numbers spell a wing loading of 15.5 to 18 ounces per square foot—very light indeed! Another great feature of the Easy Fly 40 is its all-wood construction (including the wingtips). It's covered with UltraCote™ and, according to Horizon, it has "hands-off" self-righting flight characteristics. The best part, however, may be the list price of $149.95, which means that you'll probably put one in your hangar for around $110 bucks after discount. We'll have a review really soon with Julie Soriano, *Model Airplane News's* managing editor, in the student pilot's seat.

HANGAR 9'S Easy Fly 40

MODIS (operandus?)

The new Modis is a revolutionary development from Robbe. This little "magic box" will log such things as motor rpm, current, voltage, temperature, speed and altitude while the model is being operated! The Modis permits up to six sensors to be used simultaneously. The logging of the values can be switched on or off by means of a signal from your transmitter. Thanks to its large memory, the Modis can log input from all six sources for up to 55 minutes. Afterward, the results can be read using a PC or laptop computer and the included software. The possibilities seem endless. Time to test that variable-pitch prop for electrics you were going to construct out of a heli tail rotor? Contact Robbe Model Sports, 180 Township Line Rd., Belle Mead, NJ 08502; (908) 359-2115; fax (908) 359-1415.



Mein Spion (spy) in Deutschland

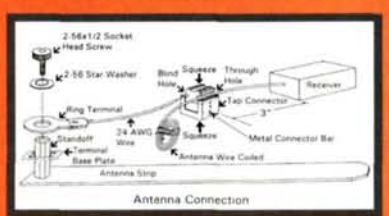
John Barnitz, originally from America but now living in Germany and working as a B-747 flight engineer for Lufthansa, sent me the photo and information on this 3W three-cylinder radial he saw at the Intermodellbau Show in Dortmund this past April. The new powerplant has a displacement of 105cc and is rated at 11hp at 4,500rpm. It has an integrated 1:2 ratio planetary gear drive and rear rotor-valve induction system using one carburetor. I'm told that the new motor will be available here in the USA, but I don't know when. Contact Desert Aircraft, P.O. Box 18038, Tucson, AZ 85731; phone/fax (602) 722-0607. Thanks for being my spy in Germany, John. Your reward? A free one-year subscription to *Model Airplane News*. All you good spies out there, this offer is open to you, too!

For the Big 4-Banger

This YS 1.20 is mounted on Vibra Damp 4-stroke soft mounts and aluminum T-beams from Performance Products Unlimited. Designed for .90 to 1.20 4-strokes, these mounts have gone though extensive field testing, including a third-place finish at the '91 F3A World Champs, a '93 Nats win and a '93 F3A Masters win. The T-beams, which will be drilled and tapped for the Vibra Damp soft mounts, will be available this summer. Contact Performance Products Unlimited, 7093 E. Dodge Rd., Mt. Morris, MI 48458; (810) 631-4894; fax (810) 631-4890.

CONCEALED ANTENNAS

Never know where to put that unsightly antenna on your pristine flying machine? Royal Products new Stealth Strip, which can be completely hidden, is for you. Although it looks rather simple, the Stealth Strip isn't just a piece of copper; it's a copper-clad dielectric. According to Royal, this unit offers up to a 4dB gain over original equipment antennas. Moreover, this type of gain has the same effect as doubling the transmitter output. Attachment doesn't require severing the original antenna wire. Its list price is only $13.95. Contact Royal Products Corp., P.O. Box 5026, Denver, CO 80217-5026; (303) 778-7711; fax (303) 778-7721. I've turned over the Stealth Strip to "Simple Programming" columnist Dave "Lord Admiral" Baron; he'll report back on the new gizmo and explain the term dielectric. I already know what it means, but I'm not tellin'!



Jamara Pro 4

As yet, I don't have much info on this new radio from Jamara/Alpha USA, but it is FM, it does have servo-reversing, and it's only going to cost about $100 with dry-cell operation. I'll keep you posted. Until then, contact Alpha USA Inc., 55 Leveroni Ct., Novato, CA 94949; (800) 685-8290.

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

OSCAR'S SUPER SKYBOLT

Oscar Cespedes Jr. of Coral Gables, FL, has nothing but good things to say about his new, ¼-scale Super Skybolt that he built from an R/C City kit. The top wing spans 77 inches and the bottom, 66 inches, and the fuselage is 67 inches long. The wings and tail are built-up balsa and ply, and the fiberglass fuselage has molded-in rivets and panel-line details. The 18-pound model is powered by a Zenoah G-62. MonoKote is used on the wings and the tail, and the fuselage is finished with automotive paints. Oscar says that the model flies extremely well; he plans to take his new biplane delight to many IMAC contests.

STUNNING STEARMAN

Built by Bill Fehrenbach of Warren, PA, this Stearman PT-17—shown here with Bill's 14-year-old daughter Laura—has a 77-inch wingspan and weighs 15 pounds. The model was scratch-built from Ziroli plans and is powered by a SuperTigre 2000 glow engine. The bipe is covered with Goldberg Ultracote film and has a Futaba radio for guidance. Bill comments that the primary trainer is an excellent flier.

ORIGINAL HEAD WIND

Dan Simenson of Oak Harbor, WA, scratch-built this sport model from his own plans. The 52-ounce Head Wind has 581 square inches of wing area and has a 51-inch wingspan. The model was originally powered by an old McCoy .19 equipped with a Veco .19 carb. The model flew well, but idle wasn't reliable, so Dan switched to a Blue Bird .28 heli engine for more than enough power and a superb idle. Construction is traditional balsa and plywood, the model is covered with Coverite's Black Baron film, and it also has a homemade fiberglass cowl.

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

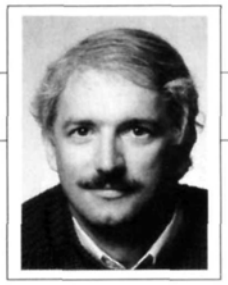
All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1994. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

IMAC ULTIMATE

This beautiful Carl Goldberg Ultimate Bipe was built and finished by Chris Fouquet of Los Altos, CA. Built for IMAC competition, the model is powered by an O.S. FS 1.20 Surpass I engine with an internally mounted tuned pipe. It took six months of "attention-to-detail" construction to complete, and it's covered with Coverite's Black Baron film. A Futaba PCM radio (mounted in the aft fuselage to help balance the weight of the large engine) controls the Ultimate. Chris says that with the internal exhaust system, the model stays clean (except for the tail wheel), and it's the quietest model at the flying field.

AEROBATICS MADE EASY



DAVE PATRICK

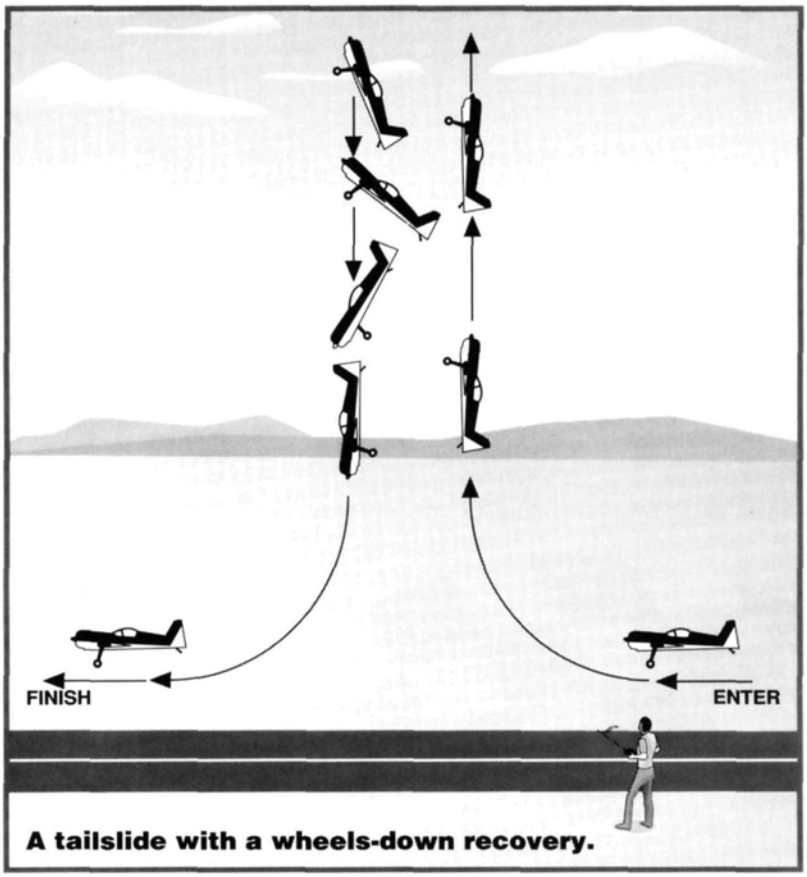
MASTER THE TAILSLIDE

SOMETIMES WE DO tailslides by accident! But this month, let's take a closer look at this maneuver, because learning how to perform one correctly is really pretty difficult. In fact, this is a classic case in which the maneuver is easier to perform in a full-size aircraft than with its miniature R/C cousin.

First, the definition of tailslide: the objective is for the aircraft, while going vertical, to stop and then slide backward, i.e., straight backward toward the ground without yawing or rolling off heading. To recover, the aircraft pitches (or "flips") to a nose-down position, and then it continues on its course. There are two recoveries from a tail-slide: wheels up and wheels down. In a wheels-up recovery, the landing gear describes an arc upward and over—in effect, across the sky, as the plane pitches nose-up. The plane thus falls backward through an inverted position to a nose-down position. In a wheels-down recovery, the landing gear drops forward as the nose pitches down.

There are two basic entries: upright (you pull on the elevator and go up) and inverted (you push and go up). In turnaround aerobatics, the tailslide can be used to reverse direction. If you enter upright and recover upright, you'll be going in the same direction, but if you enter upright and recover inverted, you'll have changed direction.

Entry into a tailslide is similar to that of a torque roll and just as critical for success. You should probably learn the tailslide first; then, once you're fairly comfortable with its setup and execution, learning the torque roll will be much easier.



A tailslide with a wheels-down recovery.

The tailslide is precisely what the name suggests: making the aircraft move backward on its tail toward the ground. How much? Well, to some, like the judges at the TOC, all you have to show is "some" movement backward, and it qualifies.

EXECUTING THE TAILSLIDE

Let's proceed through a wheels-down tailslide, from upright, as this is probably the easiest version of the maneuver. As always, you should practice the maneuver in your mind and with a small hand-held model. It really does help! From straight and level flight, pull up into a one-quarter loop; this means you're now going straight up. I can't tell you how important it is to get the straight part "straight." If you were compensating for wind in your level flight, that's OK, but when you pull up, you must *not* compensate for wind. If you're crabbing to compensate for a crosswind when you're going vertical, you'll "flop" the maneuver into the dir-ection of the crosswind.

For example, if you're flying right to left, and the wind is blowing directly into your face, your plane will be slightly crabbed to its right in order to maintain the desired track. When you pull up into the vertical, you'll need to stop the crab action by adding left rudder during the up-swing. The left rudder takes out the yaw correction (crab) that was re-quired to compensate for the crosswind when flying on the horizontal. Again, don't try to compensate for the crosswind on the vertical line. Moreover, since the wind is blowing in your face, you'll want to start the maneuver a little farther out, depending on the strength of the wind. This is a timing question as well, since the harder the wind, the quicker it will tend to blow the plane in your direction. So before you attempt the tailslide, make any adjustments for wind-induced drift by careful placement of the aircraft.

OK, now you've established a great, straight, vertical line. Carefully throttle back to an idle, but keep an eye out for any heading loss (the nose should point straight up). The aircraft will stop climbing and, at that moment (not sooner or even a fraction of a second after the aircraft has stopped) apply full up-elevator. The elevator will work "backward" as the plane slides backward and push the nose down (the air sees the oncoming deflected elevator as an airfoil at a steep angle of attack). This results in a wheel-down recovery. *Accuracy and*

Here's how to execute the wheels-up variation: at the point of stopping on the vertical upswing, simply input full down-elevator, and the aircraft will recover by pitching its nose up. You may also begin from inverted.

timing are the keys to a good tailslide. If you pull up-elevator too soon, or with too much power, the nose will pitch up instead of down.

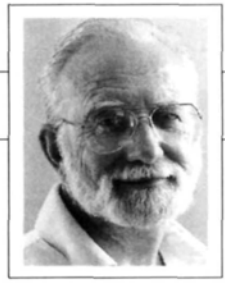
When the plane "flips" direction, it may oscillate a couple of times in the pitch axis. That's fine, and this isn't considered a downgrade in competition. The plane will recover going straight down and, to complete the maneuver, simply pull to upright.

Here's how to execute the wheels-up variation: at the point of stopping on the vertical upswing, simply input full down-elevator, and the aircraft will recover by pitching its nose up. You may also begin from inverted. Remember, if you enter the maneuver inverted, you push (down-elevator) to go up!

OK, now here's a trick to help you out, but don't tell anyone I told you. In competition circles, it's a big no-no if they (the judges) see it. When you establish your vertical line, very slightly lean the aircraft to favor the recovery desired. For example, if you want a wheels-down recovery, your vertical line should have a slight nose-down angle. This ensures a wheels-down recovery, but it can cost big points if you're being judged. Don't tell anyone, but we all do it!

Well, there you have it. You can add the tailslide to your list of can-do's. It's not difficult, but it does take some practice. Till next month! ■

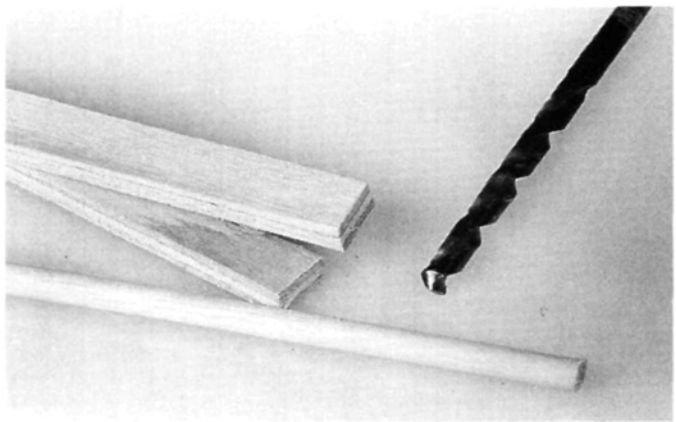
How To:



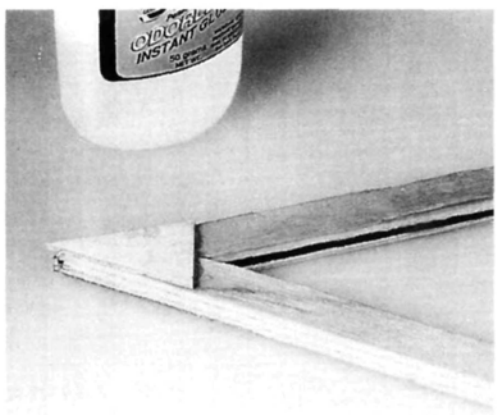
RANDY RANDOLPH

MAKE A SIMPLE TRANSMITTER STAND

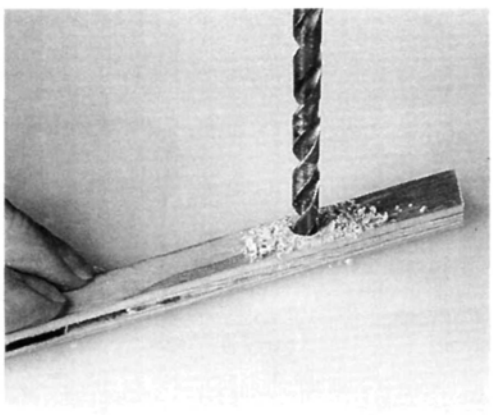
It helps if you can keep your transmitter upright while you're tuning an engine at the field or setting servo throws in the shop. The photos show how to make a stand that will hold the transmitter at a convenient angle.



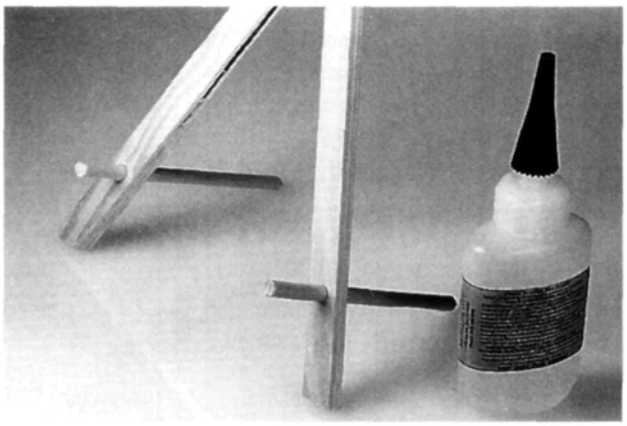
1. You'll need two 12x1-inch pieces of ¼-inch plywood or hardwood; a ¼-inch dowel that's 10 inches long; a small, triangular piece of 1/16-inch plywood; a drill; and a ¼-inch drill bit.



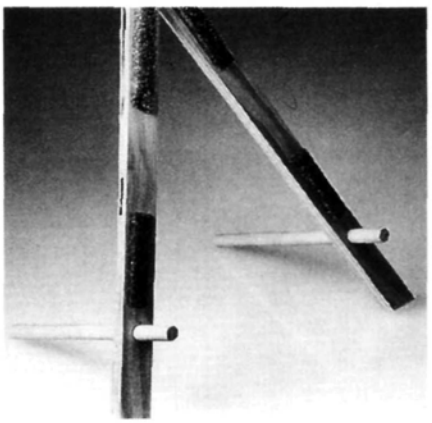
2. Bevel the end of each plywood strip so that each forms a 30-degree angle, and glue the ends together with epoxy or thick CA. To reinforce the joint, cut a small triangular piece of 1/16-inch plywood, and attach it to the strips as shown using small brads.



3. Drill a ¼-inch hole that's 1½ inches from the bottom of each leg. Bevel the bottom of the legs so they'll sit flat on a level surface.



4. Cut the dowel in half, and insert each 5-inch piece through one of the holes so that 1½ inches protrude. Gluing the dowels in place is optional.



5. The stand should be painted or varnished if you plan to use it outside. Add strips of foam tape to the two legs to provide a soft, non-slip surface against which the transmitter can rest.

6. All controls are easy to use with one hand when the transmitter is on the stand. ■

MODEL AIRPLANE CONSTRUCTION NEWS MAGAZINE

PART 1

The Vertigo crawls slowly into the wind. When the nacelle begins to rotate, the plane will pick up forward speed on its way to a transition to traditional horizontal flight.

the Vertigo

The first vertical takeoff and landing (VTOL), fully transitionable sport R/C design in history

VTOL R/C SPORT MODEL

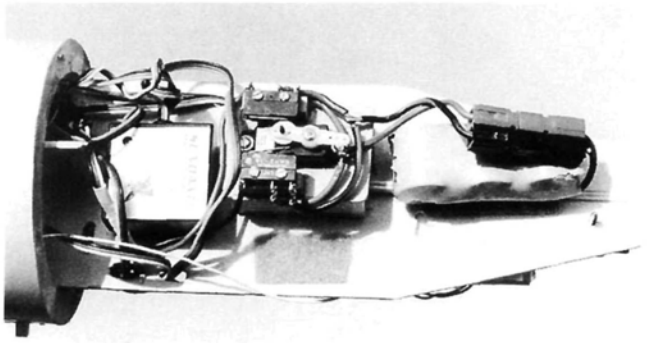
by TOM HUNT

The author prepares for a flight.

EVER SINCE MAN learned to overcome gravity and to fly, the advancements in aircraft technology have been predominantly driven toward the increase in speed of the vehicle. When the helicopter finally became a reliable way of ascending to and descending from the heavens vertically, it was quickly learned that the helicopter would never be as fast as its fixed-wing brethren. In the late 1950s, man began to experiment with vehicles that could take off and land like a helicopter, but be as fast as the best "jets" of the era. Many different schemes were tried. Many failed. Some had mild success. A few became operational with major air forces of the world. This VTOL (vertical takeoff and landing) performance came with a *big* price tag, and commercial and military interest naturally waned. Some 30 years later, VTOL aircraft are becoming popular again, mainly because powerplants are becoming lighter with more available thrust; aircraft are becoming lighter because of the use of composites; and complex computers are available to fly the aircraft when a pilot cannot (stability) or will not (drones).

The clean lines of this revolutionary sport VTOL are appealing on the ground and in the air. Will you be the first to fly one at your club field?

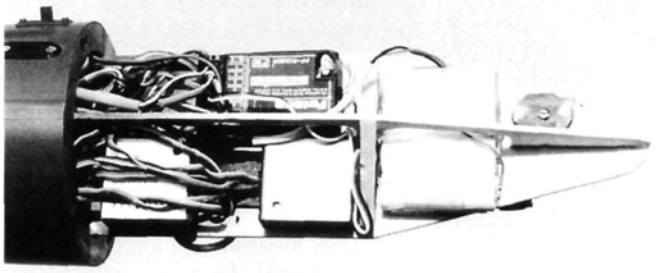
I work for Grumman Aerospace and Electronics. My company has developed, mostly on paper, quite a number of VTOL aircraft in the last 20 years (see the sidebar in "R/C VTOL Makes History," *Model Airplane News*, October '93). In my employment here, I have, on occasion, been asked to design and fly radio-control models of some of these designs. Most of the models that I have personal experience with were built by some talented modelers in the Grumman Model Shop. All but one of the models built were strictly hover models (no forward flight capability). The last model (which was the subject of the VTOL article presented by John Gorham in the October '93 issue) did fly the full flight profile, i.e., it took off vertically, transitioned into forward flight, then returned to a hover and landed. This was a reasonably complex model. It was powered by two 6-inch Hurricane* fans and two O.S.* .91 engines that rotated through 90 degrees to provide thrust vertically and horizontally. A vane-control system (a Grumman patented design) controlled this model in the hover and transitional modes. Conventional "aero" surfaces controlled the model during forward flight.



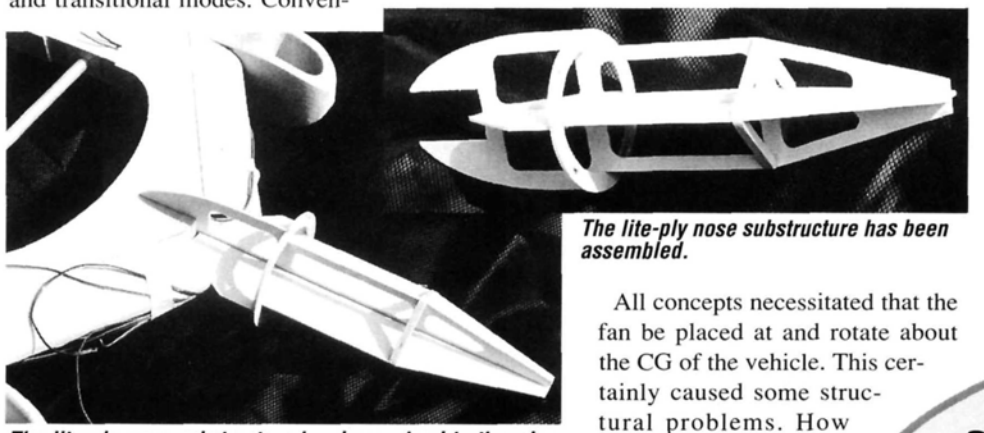
A view of the radio installation in the podded nose (bottom view). A Sundance solid-state gyro is mounted aft; a nacelle-tilt servo and microswitches, next; and a 3-cell 600mAh nacelle-tilt battery farthest forward.

THE LIGHT BULB

A burning desire came over me to design a much simpler model (one that any experienced modeler could build and fly), using all that I had learned from the previous hover models and this last "transitionable" model. The model should have a single engine and an easy-to-build shape and use a "prop fan" for propulsion rather than an expensive (and temperamental) ducted-fan unit. It should be small to keep weight down and make it easy to transport. Many designs flew through my head before I decided on the vehicle you see shown in these pages. A few possible solutions came to paper and are shown on the next two pages.



This is the radio installation in the podded nose (top view). Sundance solid-state gyros are on the top right-hand side; the receiver is on left; and a 4-cell 800mAh receiver pack can be seen on top in front.



The lite-ply nose substructure has been glued to the wing center section. Note that the booms have also been attached.

The lite-ply nose substructure has been assembled.

All concepts necessitated that the fan be placed at and rotate about the CG of the vehicle. This certainly caused some structural problems. How does one get any strength in a wing with a big hole in the middle? And what happens when the fan rotates through from vertical to horizontal and back again? There can't be any structure behind the fan for the thrust to exert a force on, or the model may pitch up or down wildly. Concepts 1 and 2 were my first thoughts that overcame these problems. However, Concept 1 violated my no-ducted-fan rule (it was designed around the Hurricane 6-inch fan unit). Concept 2 had merit, though. A twin boom arrangement would allow clear passage of the air out through the rear of the vehicle. The booms could carry all the necessary equipment, but could the vehicle be balanced? Would it be tail-heavy? Could I spread the equipment equally to the left and right sides to balance the vehicle laterally? The propulsion unit would be a homemade, 9-inch-diameter prop fan, i.e., a high-horsepower, high-revving engine would drive a conventional propeller inside an enclosed shroud (nacelle).

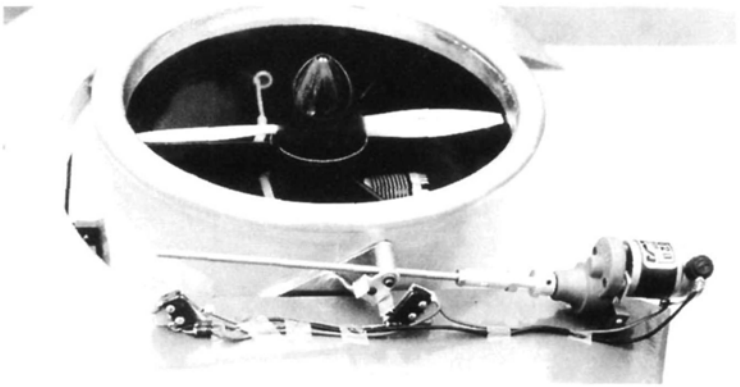
All the concepts require long landing gear to allow the fan and vane assembly to rotate without striking the ground. (Vane position with respect to the vehicle's CG is critical and will be discussed next month.) A tail-dragger, four-wheel landing gear was envisioned for strength and stability.

Fuel must be stored at the CG. VTOL models do not tolerate CG shifts caused by fuel burn-off. As fuel burns off ahead of the CG, the model will become tail-heavy, tip its tail down and begin backing up. The opposite is true if the fuel is stored aft of

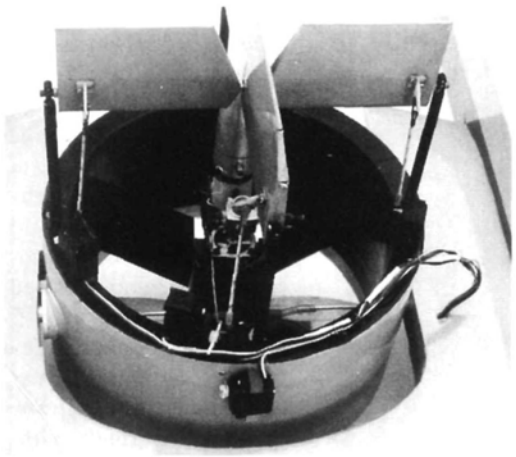
SPECIFICATIONS

Wingspan: 65.83 in.
Wing area: 645 sq. in.
Wing airfoil: inboard section; 1.5-inch slab symmetrical, 0 degrees incidence, outboard section; NACA 2412 with 2 degrees positive incidence at side of boom, -1 degree at tip.
Wing dihedral: 2 degrees (top of wing flat)
Length: 58.19 in.
Weight: 9 lb. (dry)
Power: O.S .46 VRDF in homemade "prop fan" nacelle
Prop: 9x5 Zinger* or Rev-Up*
Rpm at max. throttle: 18,000
Available thrust: more than 10 lb.
Fuel: 15-percent Cool Power in two Sullivan* 6-oz. tanks
Fuel consumption in hover: 2 oz. per min.
Nacelle-tilt angle: 0 (horizontal) to 85 degrees (vertical)

Bottom view of the nacelle showing off the servo and pushrod installation for the hover control vanes.



The nacelle is in the vertical position. Note the arrangement of the drive motor/lead screw and bellcrank. Also note the position of the microswitches used to stop the nacelle tilt at 85 degrees (vertical) and 0 degrees (horizontal).



Another bottom view of the nacelle.

the fan pivot. For small changes in CG, the hover control vanes can be trimmed to compensate. However, one would not be too happy if one had to be clamoring for the trim switch during an inbound transition!

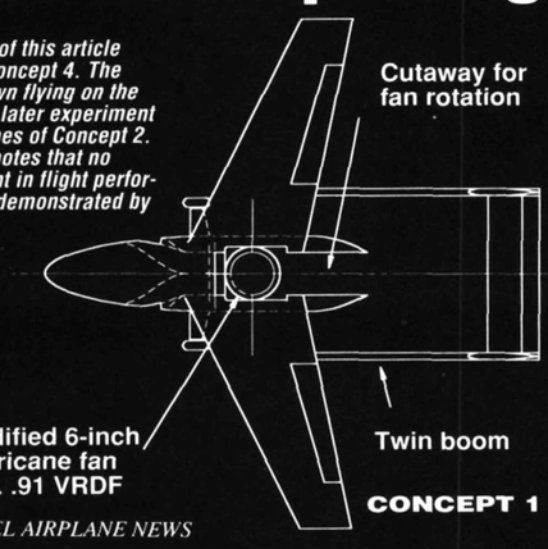
After debating this concept at length with myself, I decided to start construction of the vehicle represented by Concept 3. This concept had a central pod that unavoidably blocked the entrance of air to the fan while in forward flight. This was viewed as a minor problem, as the model only needs one-quarter of the horsepower to achieve horizontal flight as it does to achieve vertical. The pod would *not* rob the fan of three-quarters of its power! The central-pod design allowed me to stow all the equipment on the vehicle center line and, therefore, adjust the fore and aft CG more easily. The wing has a generous sweep angle to allow the aerodynamic center (AC) of the vehicle to coincide with the center of the fan. The constant-chord horizontal tail (slab design) was installed atop the vertical tails to remove it from the wake of the fan. The model would use two 6-ounce tanks, semi-submerged in the top of the left and right booms at the fan pivot (CG). The main wing spar (¾-inch aluminum tube) not only acts as the load carrier, but also doubles as the nacelle pivot shaft. The nacelle was designed to carry the load generated by the outboard wing panels. It has a pair of plywood rings to which the pivot blocks are secured. This "hoop spar" nacelle stiffens the model considerably when the fan is horizontal and the greatest load (4Gs; horizontal flight) is experienced. When the nacelle is vertical (takeoff and landing), it does not offer as much strength (the hoop now lies flat), but it is not required because the wings are not lifting. The tubular spar needs only to be able to carry the weight of the model (1G) and maybe a hard vertical landing (2G).

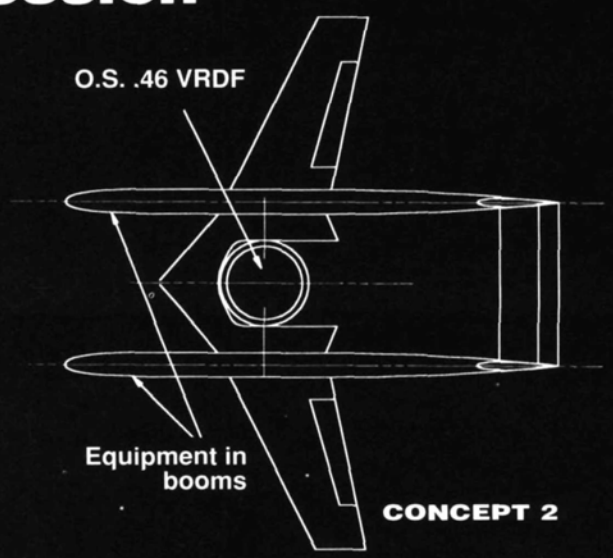
This first model flew very well; however, it had a nasty tendency to loop during the "inbound transition." As the nacelle began to rotate (from horizontal to vertical), the model would pitch up quite rapidly. Rather than forcing the model to do something it didn't want to do (fly straight ahead), I would continue the "pitch-up" into a rather tight loop while the fan continued to rotate. It worked. It wasn't pretty, but it was a safe way to get the model back into a hover from horizontal flight. (An explanation of this phenomenon will be presented in Part 2.) Since major surgery would be required to make the changes necessary to fix this problem, I decided to build a completely new model with the changes shown in Concept 4. These changes not only allowed better inbound and outbound transition control, but also enhanced the structural strength and lowered the overall weight of the model.

Later, I will discuss the construction of the second model further, touching on only

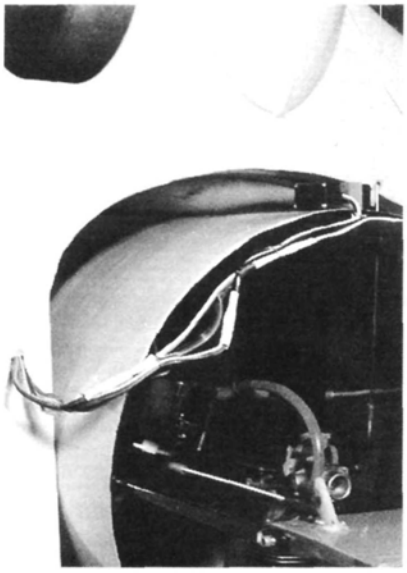
VTOL Concept Progression

The subject of this article embodies Concept 4. The Vertigo shown flying on the cover was a later experiment along the lines of Concept 2. The author notes that no enhancement in flight performance was demonstrated by that model.

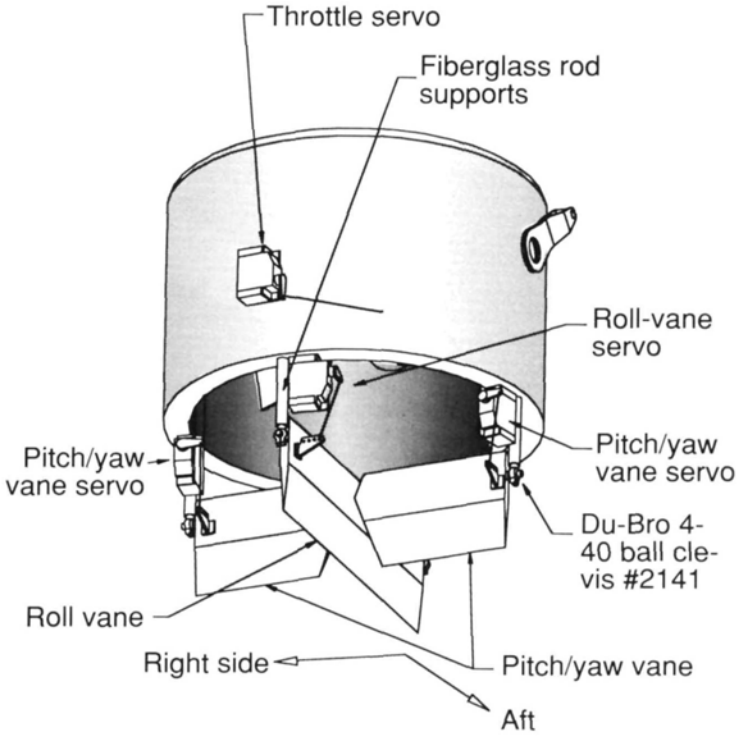




The nacelle is caught by the camera on its way from horizontal to vertical.



The nacelle-servo cables exit from the lower right-hand side of the wing center section, near the pivot, and jump across to the nacelle. Secure the cables together every 2 or 3 inches with waxed dental floss. Then secure the wire bundle to the nacelle. Check for free movement throughout the nacelle's rotation.



Control Vane Assembly

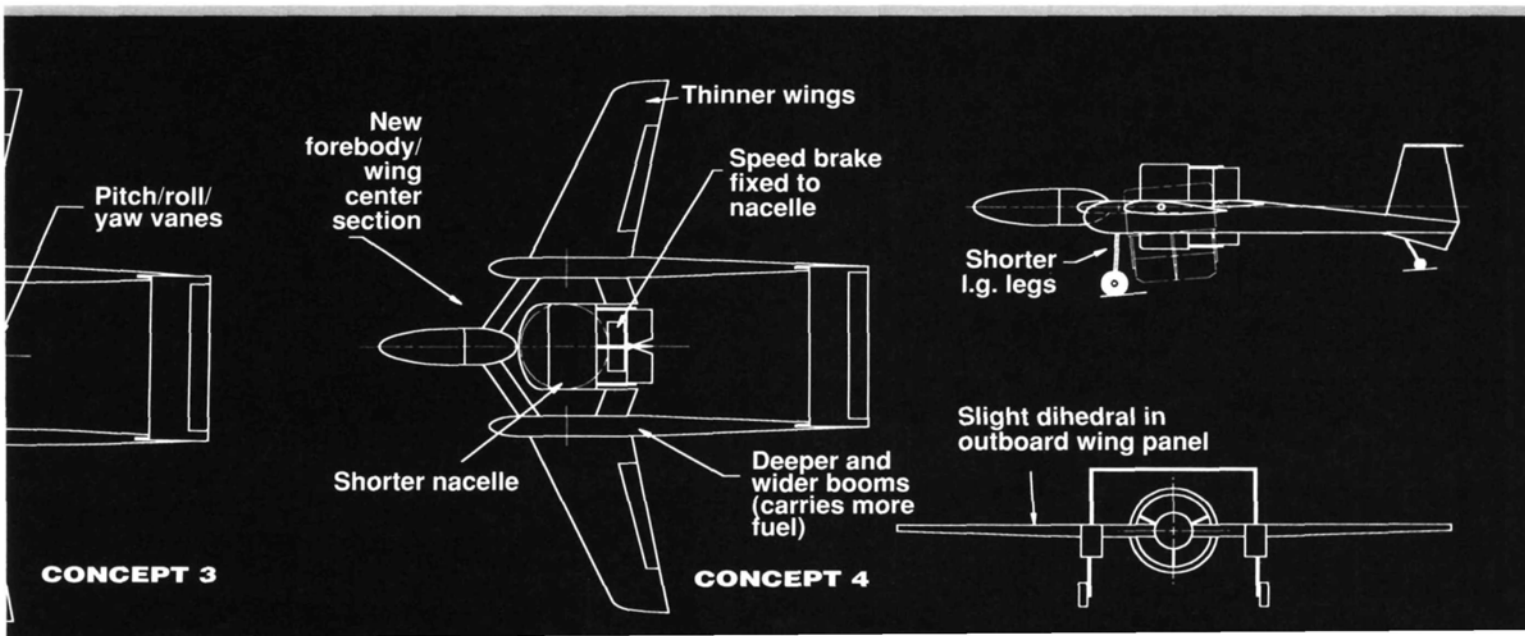
those steps and parts fabrication that even the experienced modeler may not be familiar with. Before I get to that, I would like to talk about some of the special hardware, tools and skill levels one must possess before attempting this project.

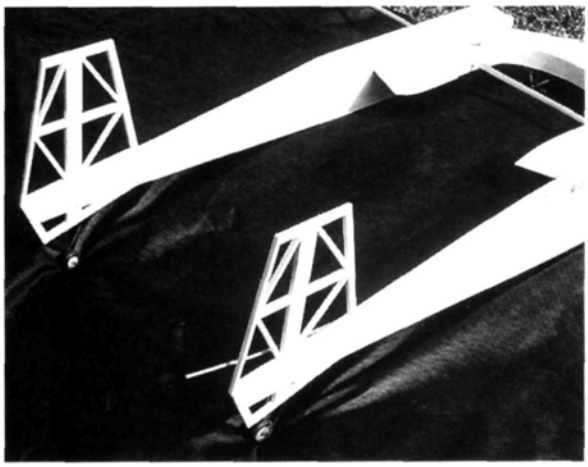
SKILL AND HARDWARE REQUIREMENTS

I had very little model helicopter experience before I started flying "hover" models for Grumman in the late 1980s. All the models I flew began flight testing on a safety harness (tether). This harness, attached at the CG of the model, would be used to save the vehicle from damage should something (or someone) fail mechanically or emotionally! The models were supported from an overhead rafter in an empty hangar, and a helper was enlisted to make sure the tether did not get ingested in the fan. This technique permitted evaluation of stability and control of the model and gave the pilot "simulator"-like practice. After a while, the tether was removed, and the model was flown outdoors. This may not be a practical self-teaching method for the average modeler. A technique I have used when a tether and hangar are not available is to fly and trim the model right out of the hands of helpers supporting each wingtip. Should the model become errant, the helpers can snatch it quickly without damage. (You wouldn't want to try that with a 48-inch rotor, helicopter pilots!) Helicopter experience is recommended, but not required, for the experienced flier. (Fixed-pitch choppers emulate well the hover flight characteristics of this type of model. I bought one a few years ago just to stay in practice.)

EQUIPMENT

You need this hardware to complete the project: a programmable radio is a must! (Sorry!) I will get into this more later, but you need vee-tail-type mixing, fully adjustable rates and reversing and programmable cross mixing. If one uses a





The vertical tail assemblies have been glued to the booms.

mechanical vee-tail mixer, two gyros are required—one for the pitch axis and one for roll. (Futaba* G-154s are acceptable, but for lower weight, ease of installation and considerably less current draw, I recommend the Sundance Model Products* solid-state gyro, no. SSG-1.) Three gyros are required if you use transmitter-programmed vee-tail mixing (one for the pitch channel, one for the yaw channel, i.e., for pitch-axis sensing, and one for the roll channel). Six microservos on the nacelle are required if you use mechanical vee-tail mixing (one for throttle and five for vane control), and four microservos, if you use transmitter mixing (one for throttle and three for vane control). One microservo is needed to drive a microswitch for nacelle tilt and one standard servo for elevator. You'll use one mini-servo in each wing for aileron control. A 5-cell, 1200mAh battery to drive the receiver is required if you use mechanical gyros. (The voltage drop induced by the running of the two to three mechanical gyros is considerable, but make sure your receiver is capable of taking 6 volts.) A 4-cell, 800mAh receiver battery is more than sufficient if you use the solid-state gyros.

A 3-cell, 600mAh battery drives the nacelle tilt motor, which is a 40 to 50W, 1/8-inch-shaft electric motor. (I used the now rare Astro* 020, but a Kyosho* AP-29 or a HiLine* Imp 50 will work with some mounting modification). You'll need a 3.5x1 Master Airscrew* gearbox, 12 inches of 10-32 threaded rod, four 5A microswitches, three 3A diodes, 36 inches of Dave Brown* fiberglass pushrods (main landing-gear assembly and vane supports), 24 inches of 1/2-inch-o.d.x0.047-wall aluminum tube (main spar), two 6-ounce tanks, wheels, foam, balsa, plywood, clevises...the usual!

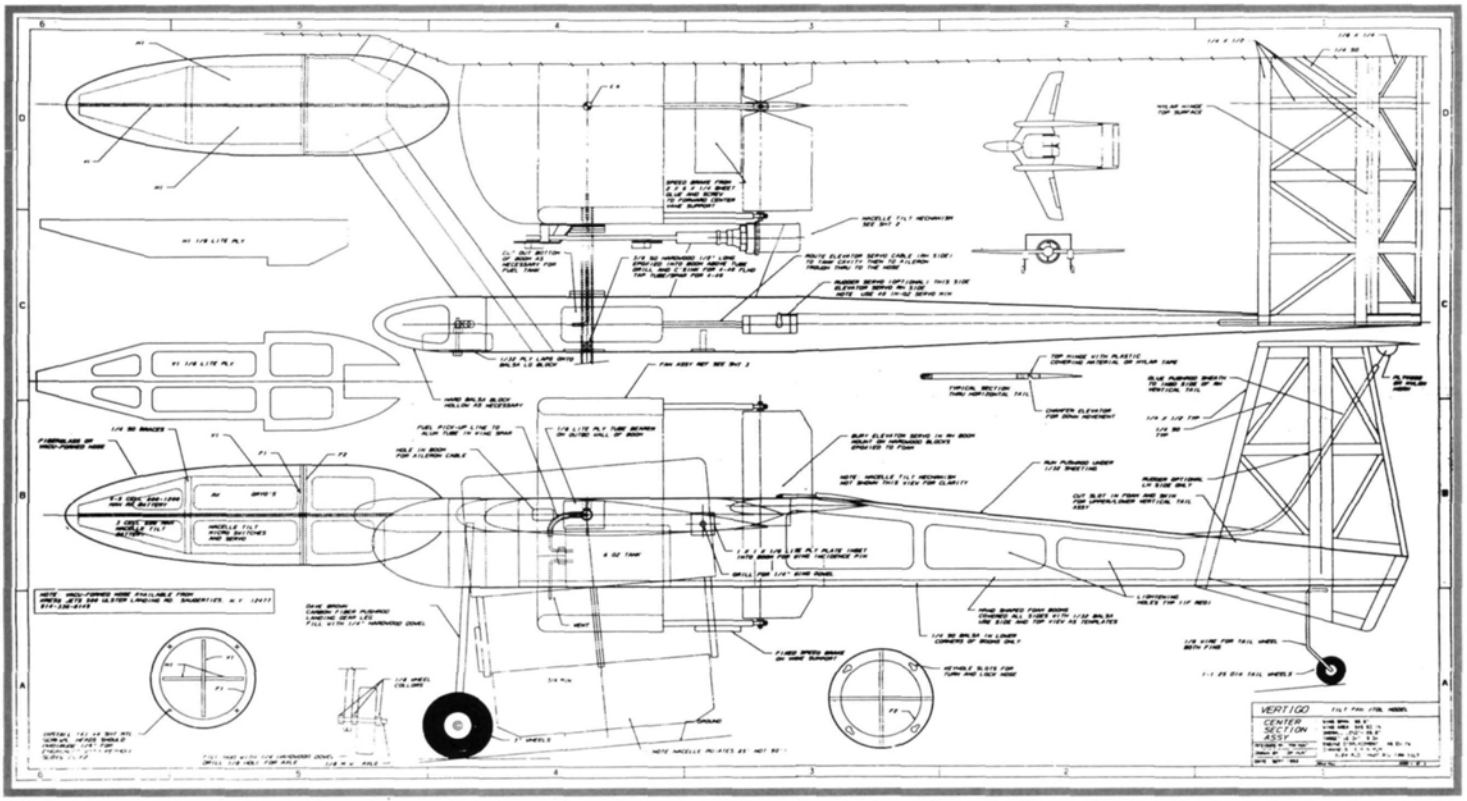
The foam boom assemblies have been completed. Note the holes for the spar tube and the aileron extension cables.

I tried desperately to keep special tools and materials out of the design; however, you will need a lathe (or someone who has one to help you) to make a 10-32 to 1/4-28 threaded adapter for the tilt nacelle lead screw assembly.

MODEL CONTROL

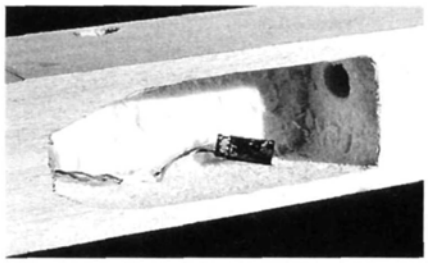
Control of the model in the hover and transition modes is accomplished using a set of movable vanes mounted below the fan on tubular supports (see illustration). A single vane mounted front to back controls the vehicle in the roll axis. Two vanes mounted 90 degrees to the roll vane (one on the left-hand side; one on the right) control the model in pitch and in yaw. Both vanes move in unison to provide pitch and in opposition to provide yaw (similar to a vee-tail aircraft). Servos mounted to the aft section of the nacelle drive all these vanes. Another servo, mounted to the fan externally (lower center line), is connected to the throttle arm on the carburetor.

Control of the model during forward flight is accomplished using conventional ailerons and elevator. These devices have their own servos. The roll, pitch and yaw vanes remain active during forward flight; however, they con-

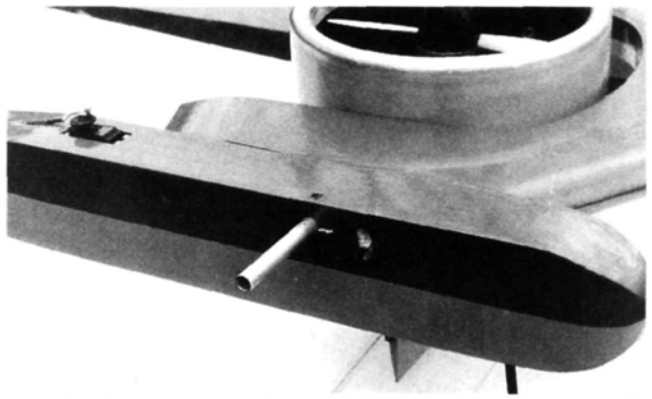


One of three plans sheets is shown. See the next issue for the other sheets.

tribute very little to the control power of the vehicle in this mode. The roll vane becomes a yaw vane in forward flight (direction is consistent, or "proverse," i.e., a right roll on ailerons creates a right yaw from the roll vane), and the yaw vanes (differential pitch vane) produce adverse roll (direction is inconsistent: left yaw command produces right roll); but because of the very small moment arm of these devices, this adverse condition is easily overcome by the ailerons. (You shouldn't be moving the yaw stick in forward flight, anyway!) An "aero rudder" was used on the original model. One was not installed on the feature aircraft to save weight when it was learned, from flying the prototype, that it was not needed.



This is the fuel-tank cavity. The elevator-servo cable passes through to the aft boom installation.



Note how the main spar tube exits the boom. The outboard wing is retained by a single 4-40 screw that runs through the wing into the spar.

MODEL CONSTRUCTION

• **Wings and booms.** The model wings and booms are constructed mainly of hot-wired or sanded "blue" or "pink" foam parts covered with 1/32 balsa and/or fiberglass. Follow the plans, and these will go together quickly. Don't forget the twist in the outboard wing section when hot-wiring. Put the reference line shown on the template parallel to the blank core. This will index the twist properly. Before sheeting, make wire route holes in all the foam parts for the various necessary servo and motor-drive leads. The center wing section should be given a layer of 3/4- to 1-ounce fiberglass cloth before assembly with the booms. The elevator pushrod sheath should be embedded in the foam boom before the top sheeting is attached. Slot the booms for the vertical tails last.

• **Empennage.** The horizontal and vertical tails are an open-truss-type structure made of medium-grade, 1/4-inch sheet balsa. Build over the plan, and glue the vertical to the boom assemblies before covering. Glue the horizontal to the vertical after covering. Attached to the fin post is a 1/8 wire tail-wheel leg. Bend a right angle at the top to attach to the fin, and one at the lower end for the tail-wheel axle.

• **Main landing gear.** The main landing gear were made from 1/4-inch-i.d. Dave Brown* carbon-fiber pushrods. The middle was filled with 1/4-inch-diameter hardwood dowel along the entire length. The lower end was drilled to accept an 1/8-inch wire axle retained with 1/8 collars on each side of the leg. Three-inch Dave Brown Lite Flight wheels were installed. The main gear assembly was inserted into a 5/16 drilled hole at about a 5-degree angle (forward rake) in the hard balsa boom nose block. I did not glue it in place for fear of snapping one on a hard landing and having to drill it out to replace it. Instead, I just let friction and a single, small, 1/16 pin, drilled through the nose block and the leg, do the work. Just pull the pin, and get Arnold Schwarzenegger to pull the leg out of the block to replace it!

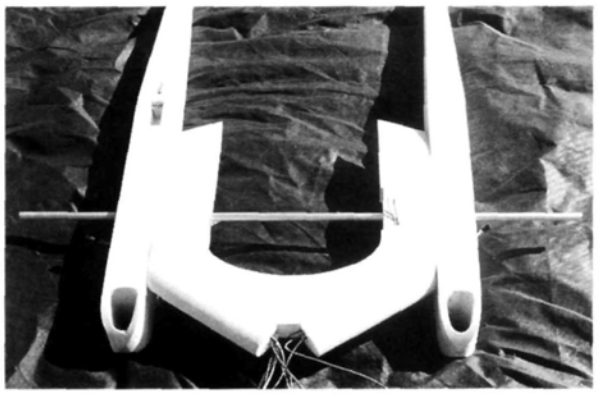
• **Nose pod.** The nose-pod substructure is made from a 1/8 lite-ply planform and profile (V1 and H1), glued to the center wing section. One-quarter-square balsa braces help keep things square up front. The prototype utilized a fiberglass forward shell and rear outside shell to form the contour of the pod. The aft section is glued to the 1/8 lite-ply ring F2 and to the wing center section. The forward piece is glued to a stiffener ring (F1) at the aft end. Four no. 4 sheet-metal screws protrude from F1, heads facing aft. These screw heads engage "keyhole slots" in F2, and a quick twist secures the nose. A little clear tape over the seam (between the front and rear halves) wouldn't hurt, just in case vibration loosens the nose. Vacuum-formed pieces for those who do not like to do fiberglass work are available from Kress Jets, 500 Ulster Landing Rd, Saugerties, NY 12477; (914) 336-8149. Call for pricing/prices.

The author trims the model in the hover mode before a flight. Try this, helicopter pilots!

• **Nacelle.** Start nacelle construction by cutting out two 1/8 birch ply rings that straddle the 1x1x1 hardwood pivot blocks. One of these rings (the aft one) should have four 5/16 holes drilled to accommodate the vane support tubes to be installed later. Drill a 1/2-inch-diameter hole through the pivot blocks before assembly. Using the 1/2-inch aluminum tube for alignment, slide the blocks over the tube, and glue one of the 1/8 birch ply rings to the blocks using epoxy. (Note that the pivot block is 1 inch below the fan center line.) Do this over the plan. Make three stator/engine supports from the 1/8 birch ply shown on the plans. Cut three 0.02-inch aluminum-sheet trailing-edge tabs to size, and glue them to the 1/8 ply, overlapping by 1/4 inch. Epoxy 1/16 sheet balsa over the aluminum tabs and 1/8 ply. Add the 1/4-inch sheet leading-edge balsa. (Don't forget to droop the leading edge, and be careful of the direction.) Put the three stator assemblies aside for a while.

The engine mount was made by turning a large hunk of maple to 2 1/4-inch-diameter and then hollowing and cutting as necessary to fit the O.S. .46 ducted-fan engine inside. The engine was secured using the normal mounting lugs and 6-32 screws.

(Tap the wood; then harden the threads with thin CA.) Using a Dremel* Moto-Tool and an 1/8-inch router bit, cut 1/8x1/4-inch-deep slots into the central wooden mount, 120 degrees apart for the stator assemblies. Glue the stator assemblies to the central mount with epoxy, and wrap the intersections with light fiberglass cloth. Working over the plan, making sure the engine is perfectly centered, epoxy the stator/engine-mount assembly to the 1/8 ply ring with the pivot blocks previously installed (you must remove the 1/2-inch tube now, but it's OK; it has done its work). When dry, glue the other 1/8 birch ply ring to the hardwood pivot blocks and stator assembly.



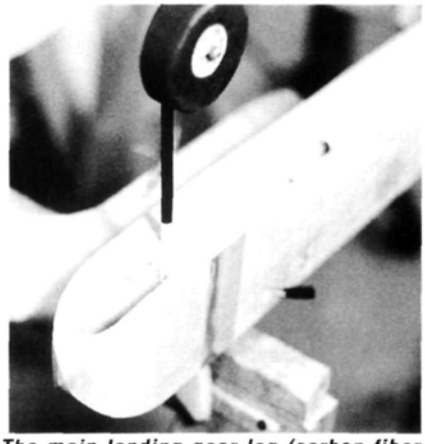
The booms have been joined to the wing center section. Alignment is aided by the wing spar tube.

This assembly, pivot/stator/central mount, is the heart of your fan. Take your time. Glue things well. Keep things aligned, and you will benefit from maximum thrust. (Prop clearance from the finished wall should be no greater than 1/32 inch.)

Next, fill the space between the two 1/8 ply rings with scraps of foam, and sand it to the inside and outside diameters of the ply rings. Glue a 1 1/2-inch-thick foam ring to the front of this assembly, and sand to shape. Make one more 1/8 plywood ring—this time out of lite-ply. This will be the vane tube support ring. Drill four 5/16 holes through the ring, 90 degrees apart, as shown on the plan. Cut a 2 1/2-inch foam ring of the same inside and outside diameters as the ply ring. Sandwich the foam between the 1/8 birch ply ring and the 1/8 lite-ply rings. Make sure to align the 5/16 holes for the vane support tubes. Shape the foam to the inside and outside diameters. Using your favorite method, bond 1/32 balsa or 1/40 obechi to the inside and outside of the entire assembly. At this point, the front is blunt with foam exposed, and the rear is blunt, showing the 1/8 lite-ply ring with the four 5/16 holes. Add a 3/8-inch-thick balsa ring to the front of the nacelle, and sand to a full radius. *Warning!* This is your fan inlet. A poorly shaped inlet means poor thrust, no matter how fast you swing the prop! So take your time shaping the inlet lip. Make yourself a leading-edge template, and sand *slowly!*

• **Control vanes.** Drill out the foam between the two aft 1/8 lite-ply rings. Cut four pieces of carbon-fiber tube to the proper length. Epoxy into one end of each of these four tubes a Du-Bro* (no. 2141) screw captured 4-40 ball clevis (R/C car accessory). These will be your vane pivot mounts. Epoxy all four vane pivot support rods to the nacelle in the holes provided. Take care that the pivots are aligned across the fan and from front to back. (Place a 3/32 steel music-wire rod through the opposite clevises while curing to keep them aligned.) Also be sure that the vane pivots are the proper distance from the nacelle pivot (1/2-inch hole). Too far away, and the vanes will strike the ground; too close, and control power and stability will suffer.

The control vanes are made from solid, 3/8-inch sheet balsa. Full radius the leading edge, and taper the trailing edge for the last 50 percent of chord. Install 1/4-inch hardwood dowels at the vane pivot (25 percent chord), and tap them for a 4-40 screw in each end of the roll vane (larger one-piece vane) and in the outboard side of each pitch/yaw vane. On the inboard side of each pitch/yaw vane, drill a hole on the vane pivot center line 5/32 inch in diameter, and install a short piece (about 1 inch long) of 1/8-inch-i.d. brass tube. Cut a piece of 1/8 music wire to bridge the gap between the two vanes. Cut a hole in the roll vane to accept this pitch/yaw vane joiner, and elongate the hole to provide clearance for the roll vane to pivot. Attach the roll vane first to its ball clevis using the hardware provided by Du-Bro. Next, insert the 1/8 wire into one pitch/yaw vane, install this assembly on its ball clevis, and slip the other vane onto the wire and then onto its ball clevis. Check the deflection and smooth operation of each vane. The vanes should not be sloppy on their mounts and must not touch one another through 20 degrees of rotation (1 inch at the trailing edge). Remove the vanes and cover or paint them to fuelproof them. Install control horns on each vane at the pivot along the outboard ends.



The main landing-gear leg (carbon-fiber tube filled with hardwood dowel) has been positioned on the boom at the correct height.

I mounted my vane servos on homemade plywood servo trays. These trays were glued to the inside wall at the aft edge of the nacelle, allowing the servos to "hide" behind the base area created by the last 1/8 lite-ply nacelle ring. This keeps the pushrods short, reducing the chance of their bending under load, reduces slop and keeps the weight to a minimum. I chose to use transmitter vee-tail mixing for yaw control. This has the advantage of a simpler servo installation, but requires the use of a third gyro to be plugged into the yaw channel (but senses the pitch axis). A mechanical mixer, e.g., the Du-Bro top-of-the-servo type, would make servo installation a little more involved, but not difficult. This mechanical mixing scheme would not require a third gyro for the yaw channel. A Y-harness would drive two independent pitch servos and independent yaw servos. Radio installation schematics for both methods of control and stabilization are shown in Figures 6 and 7 (these diagrams are provided with the plans).

• **Nacelle-tilt mechanism.** The nacelle is rotated from horizontal to vertical and back again by a very simple lead screw drive system. On my prototype, I used an Astro 020 motor attached to a Master Airscrew 3.5x1 gearbox driving an 8-inch-long 10-32 threaded rod. This rod was threaded through a rotating bar mounted to a pair of bellcranks, securely fastened to the left-hand side of the nacelle. The whole assembly was secured to the model on the left-hand side at the wing center section's trailing edge. The motor/gearbox assembly must also pivot because of the arcing motion of the bellcrank (and, of course, the lead screw that passes through it). To

(Continued on page 79)

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

by DICK PURDY

The author (left) and Jim Onorato prepare to fly.

EZ SPORTS AVIATION Baccara 45

THE BACCARA 45's name is evidently a creation of the imagination. As a model building project, it also qualifies as an imaginative creation. You are probably aware of the acronym "ARF" (almost ready to fly) used to describe the newer breed of kits. The Baccara 45, an EZ Sports Aviation kit, distributed by Global Hobby Distributors*, falls into this category, but it is unusual in that it is a close match to a classic "pattern" airplane design. The manual calls it an "R/C aerobatic sports trainer," and I believe that is a pretty accurate description.

A wood-frame ARF with pattern-like handling

CONTENTS

The contents of the kit are nicely separated and well-protected. There are main elements that require assembly and internal hardware and wood and plastic components that must be built according to the sequence provided on page 23 in the manual. Much of the builder's time is saved by such niceties as pre-hinged control surfaces and color that seems to be embedded in the surface of wings, fuselage and tail feathers. This kit includes several other items that are not usually supplied, such as wheels, a fuel tank, a spinner, an engine mount and even a pilot figure. Because retractable landing gear is an option, there is a set of plastic cups to receive the wheels in the retracted mode on the underside of the wings. A substantial set of decals enables the builder to add lots of decoration, as is customary with pattern ships, it seems.

Note how the cowl has been carved to make room for the Magnum .45 engine; a Davis Diesel SoundMaster muffler can be seen.*

The builder must supply a radio with either four or five servos (depending on whether retracts will be used) and an engine with a prop of a suitable size. I installed a Magnum* 45 2-stroke engine, which fit the kit's engine mount perfectly. I didn't use retracts, so a Futaba* 7UAF radio with four servos did the trick. I used a Williams Bros.* pilot figure in lieu of the kit figure, and I supplied all the adhesives required for construction.

ASSEMBLY

Assembly of the Baccara 45 is a simple matter of following the steps listed in the manual. Almost every step is illustrated by a good photo. The wingtips are attached to the wing panels; the center ribs and the aileron servo recess are installed; and the wing halves are joined. Plastic cover plates go above and below the center joint of the wing to strengthen the joint and enhance appearance. Because strip ailerons are already installed by the manufacturer, inserting a servo and aileron control rods takes just a few minutes of easy work. Mounting the wing on the fuselage is next, and it is prudent to take time for a careful mating and alignment of these parts. It is not a difficult task, but one that requires precision.

One of the slightly unusual design features that I found with this project was that the nose-wheel gear is not exactly centered on the firewall. An offset is used because the engine muffler will be tucked in tight near the center of the bottom of the firewall, and shifting the nose wheel over a bit becomes necessary. The wheel strut's being slightly off center does not have an adverse effect on ground-handling performance, I find.

The tracking in the air was straight and true. Inverted flight showed the need for just a tad of down-elevator. Then there was some knife-edge, and performance was super.

Mounting the tank, its tubing and the engine mount are all routine, simple steps. Precisely positioning the engine on its mount is necessary for proper fit of the cowl and the spinner, although this is not complicated either. It is now time to cut the cowl to fit the engine you have installed. Recesses formed in the cowl help the builder locate the required cutouts, but I always find this a rather tedious and time-consuming exercise. Eventually it was done, and the results are certainly acceptable.

Mounting the stabilizer and fin is next; a plastic fairing piece covers the glued joint where these surfaces meet the fuselage. Control rods are fished down through the tail end of the fuselage, exit at the pre-marked locations and run to the rudder and elevator control horns. On

FLIGHT PERFORMANCE

Here's where the Baccara 45 really shines. I asked flying pal Jim Onorato to assume the role of test pilot, to which he graciously consented.

•Takeoff and landing

The first takeoff run was perhaps 75 feet long as the plane took gracefully to the air. With a paved runway, this would probably be shorter, but the grass field where we fly slows things down a little. On rollout, the plane requires a moderate degree of right rudder to maintain heading. The Magnum .45 engine displayed more than adequate power for a quick ascent to a "three mistakes high" altitude. The plane slows down so nicely you can come in steep and flair, or mush it in onto the main gear and drop the nose. It's up to the pilot. Jim's landings were three-pointers, with a solid, no-nonsense rollout each time.

•High-speed performance

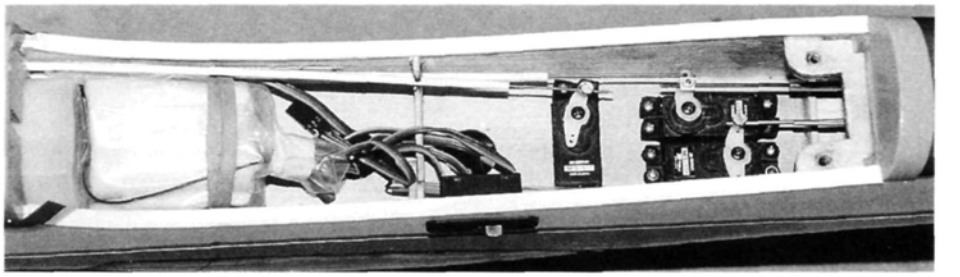
The Baccara 45 flies like a true pattern plane, and it really tracks well at high speed. There were no high-speed snaps with the control surfaces set at the recommended deflection.

•Low-speed performance

Stalls were attempted to get a feel for the handling speed at which the plane would be landing. This was really a surprise to us, in that the plane went *very* slowly before stalling out and then fell straight ahead each time. You can really slow this one down before it drops forward.

•Aerobatics

After servo trim settings had been adjusted, the evaluation of flying capabilities began. First came some simple loops to see whether tracking was true. These came out perfect each time. Then some snap rolls, followed by slow rolls. Again, the tracking in the air was straight and true. Inverted flight showed the need for just a tad of down-elevator. Then there was some knife-edge, and performance was super. The plane can spin, but must be coaxed into it a bit.



In the fuselage, there's ample room for the servos and the radio.

BACCARA 45

this model, each elevator is independent, so a split control rod is required; it separates into two rods, and each is connected to an elevator. A preformed servo tray is installed in a fixed location, and the servos are dropped into it. With the wheel struts mounted in slots under the wings, only the canopy and pilot-figure installation and the final trimming remain to be done.

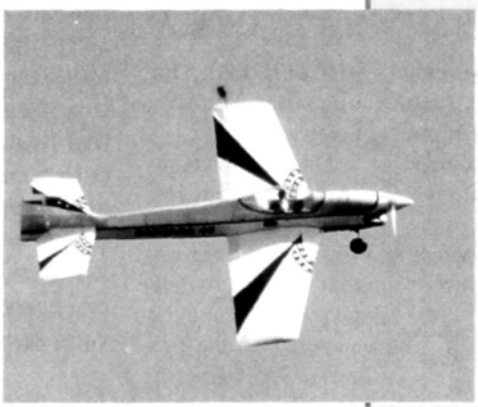
SPECIFICATIONS

Model name: The Baccara 45
Type: aerobatic sport trainer
Manufacturer: EZ Sports Aviation
Wingspan: 56½ in.
Wing area: 552 sq. in.
Weight: 5 lb., 11 oz.
Length: 53½ in.
Rec. engine sizes: .40 to .45 2-stroke; .60 to .70 4-stroke
Engine used: Magnum .45
No. of channels req'd: 4 (throttle, aileron, elevator, rudder); 5 with optional retracts
Radio used: Futaba 7UAF
Construction: ready-to-assemble components
Materials: wooden structure encased in plastic-covered foam
List price: $349.95

Features: optional retracts.

Hits
- A colorful, sleek, speedy flier.
- Can be completed quickly and easily; all parts are pre-cut.
- Parts fit is good.
- Kit supplies everything except for engine, prop, radio and adhesives.

Misses
- Decals furnished for cowl are difficult to apply.
- Pilot figure furnished is not very realistic.



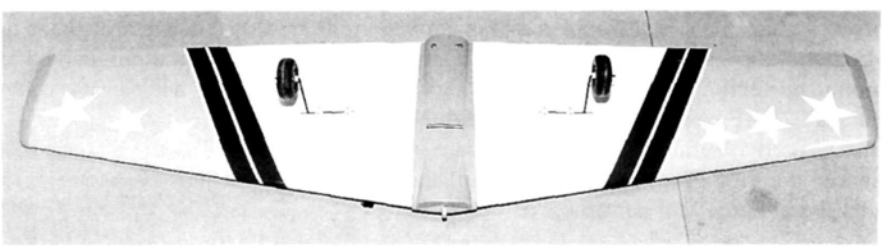
FINISHING

I found the decals for the wing and tail feathers were easy to apply. The decals for the fuselage and the cowl were more difficult to apply. According to the instructions, the material used can be heated and stretched around the fuselage and cowl. I did not find this a very satisfactory method, so I used 21st Century* primer and paints on the difficult areas. I also painted and installed a Williams Bros. sportsman pilot.

The rudder and one side of the external part of the split elevator linkages are shown.

With the assembly and the finishing steps done, the completed model looks very much like a slightly smaller version of a pattern ship. I think the sharply pointed spinner and sleek lines of the fuselage lend an appearance of speed. And the tapered wing just "looks" fast.

All in all, the Baccara 45 proved to be an admirable product for the R/C model buff. It will enable the less experienced flier to gain confidence and skill while enjoying the pure pleasure of sport flying.



Retracts can be used, but the review plane was built with fixed gear.

*Addresses are listed alphabetically in the Index of Manufacturers on page 137.

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

Left: the F-20 Tigershark set up with a hot, piped .40 engine can reach 100mph.

Below: all smiles! The author and his new F-20 Tigershark are ready to commit aviation!

Direct Connection R/C

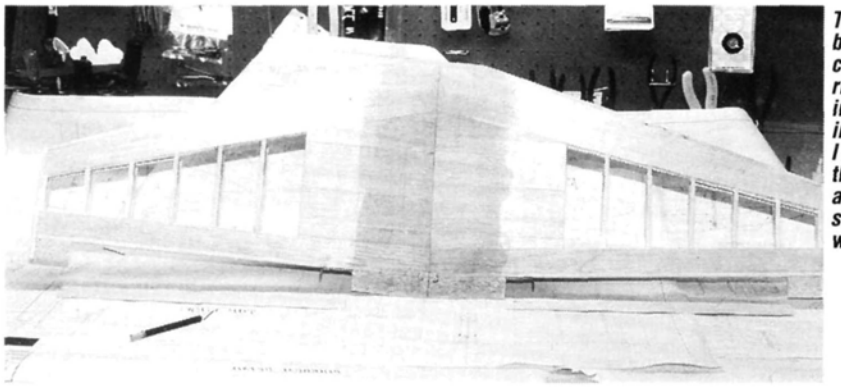
F-20 Tigershark

by BILL MIDGLEY

PHOTOS BY JOHN E. JUNDT & BILL MIDGLEY

MANY KIT manufacturers offer looks-like-a-jet, propeller-driven kits. Among the latest newcomers is the F-20 Tigershark, which is manufactured by Direct Connection R/C* (a division of Capstone Hobbies) and can be ordered directly from them.

The kit made its debut at the 1993 Toledo R/C show. Its long, sleek appearance is definitely appealing, and it could turn out to be one of the standards in its category of R/C aircraft kits.



The wing is built with cap-stripped ribs according to the instructions. I removed the capstrips and fully sheeted the wing.

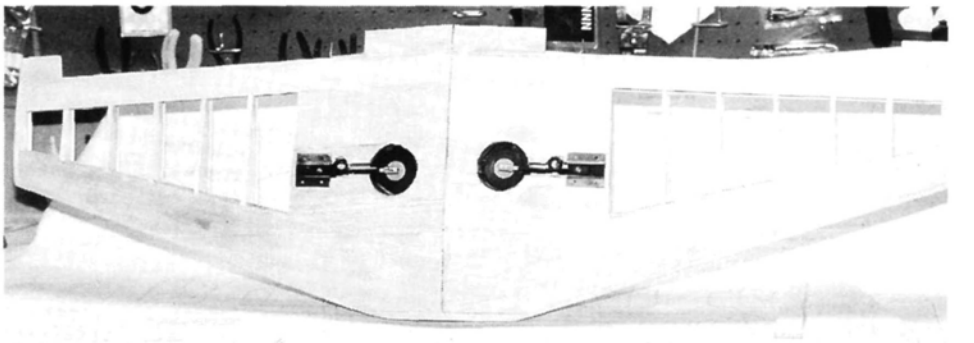
The F-20 Tigershark kit from Direct Connection R/C is definitely a high-performance aircraft for those who feel the need for speed.

A description of the aircraft adorns the cover of the instruction booklet. The kit is designed for a .40- to .46-size Schnuerle-ported engine and fixed gear. With the finished product equipped in this configuration, you can expect speeds of 70 to 85mph; add a tuned pipe to your strong running engine and add a set of retractable landing gear, and you should be able to break 100mph. These are the manufacturer's words; as I begin to write this, my F-20 is sitting in the hangar, waiting for the meltdown of 10 inches of snow!

The instructions clearly state, "The F-20 Tigershark is a high-performance, jet-like, sport-scale airplane," and they go on to say that this is not a beginners' kit. I agree that it isn't a beginners' kit, but don't let that scare you away from building it. The manufacturer supplies you with a toll-free number to call if you are unsure of just how things go together.

THE KIT

First, the instruction booklet. As I said earlier, its top cover is an introduction to the kit, and it gets you thinking about engine options—tuned pipe or not?; retracts or fixed gear?



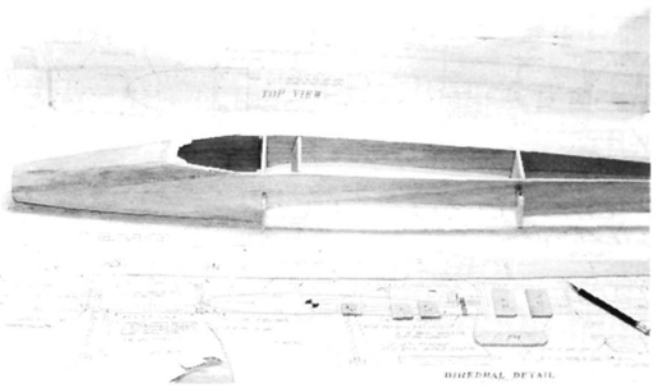
The bottom of the wing showing the installation of the main retracts.

Next is the parts list. Many of the machine-sanded parts are illustrated, and that's a great help in identifying them. Also, the place in the kit where the part can be found is identified (more on the parts marking later).

The instructions are clearly written and supplemented with drawings for clarification. The last five pages show 14 different isometric drawings of the fuselage being constructed step by step. Paragraphs are numbered, so if you have a question, you call the toll-free line and tell them which paragraph you're having a problem with—a really nice touch.

A single rolled plan sheet guides you through the construction. When I started to unroll the plan, I found that I unrolled and unrolled and unrolled.... This is one *huge* sheet! I cut the wing section out of the sheet, and that made it a little easier to handle. The plan's quality is superb. It's one of the clearest, cleanest plans I've seen, and all the information is there where it should be.

All the machine-sanded parts are in color-coded Ziploc bags, and the parts list tells you which color to look for and how many pieces there should be in the bag. Held by a rubber band, a bundle of long wood contains the ailerons, the leading- and trailing-edge pieces, triangle stock and the main spar. The fuselage sides, the top and bottom plates and the hard-balsa parts for the stab and fin are loose in the bottom of the box. Another bag contains the very generous hardware package—every hardware part needed to complete the kit (fixed-gear version). You only need to buy a fuel tank and wheels.



With the fuselage sides and nose sheeting in place, it's time to position the "D" formers, which act as standoffs for the outer fuselage.

SPECIFICATIONS

Name: F-20 Tigershark
Manufacturer: Direct Connection R/C
Type: propeller-driven, jet-like model
Wingspan: 47¼ in.
Airfoil: symmetrical
Weight: 5½ to 6 lb.
Length: 54 in.
Radio req'd: 4-channel (without retracts)
Radio used: JR X-388S
Engine req'd: .40 to .46 2-stroke
Engine used: Webra GT50
List price: $84.99

FEATURES: the kit's standard balsa-and-plywood construction help you create a sleek, jet-like model that flies well with a mid-size engine.

Hits
- Excellent flight performance throughout the flight envelope.
- Isometric drawings greatly help with kit construction.
- Plans are of excellent quality and easy to read.
- All the hardware is included.
- It looks great and is fun to fly!

Misses
- Some of the pieces of sheeting material were not marked.

FLIGHT PERFORMANCE

The snow melted, and we were off to the airport with great anticipation. The Webra GT50 came to life, and after one tank of fuel for break in, we taxied down the paved runway to line up for takeoff. I turned the F-20 into the wind and increased the throttle. Straight down the center line, a little back pressure on the elevator control, and we were flying. The workload of the trim passes consisted of two clicks of left aileron trim and one click of down-elevator. After trimming, the first thing I noticed was that the F-20 tracks as if it's on rails; you point it and that's where it goes.

• Slow flight

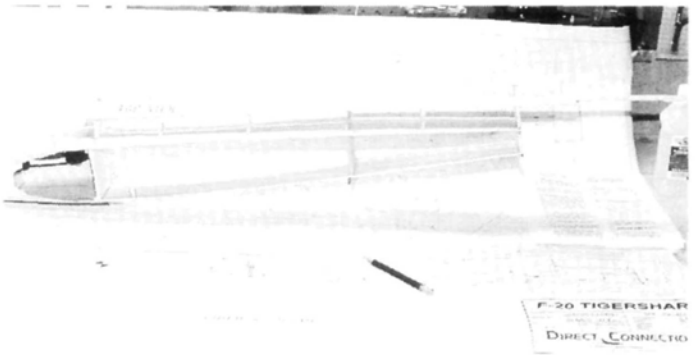
The F-20 appeared to be right at home in slow flight. No tip stall was noticed, nor were there any other bad or surprising tendencies. All the flying surfaces remained effective throughout the flight profile.

• High-speed flight

This is what the Tigershark was bred for. Initially, I experienced a slight high-speed rudder flutter. This was quickly solved with a little adjustment of the rudder linkage. For the first flight, I set up the low rates on the X-388S radio to 75 percent of the high-rate positions, and this proved to be more than adequate for high-speed maneuvering. The F-20 Tigershark smoothly streaks across the sky with the grace of a true jet.

• Aerobatics

Although not designed as an aerobatics or pattern-type aircraft, the F-20 is still capable of doing all the air-show aerobatics that you can perform. The kit is built with one servo for aileron control, but for smooth axial rolls, it needs some differential (a function of where the linkages are attached to the servo wheel). This will give you more up-aileron on one side than down on the other. There's enough room in the wing to allow the installation of independent servos for the ailerons, but this is not mentioned as a builder's option in the instructions or on the plan. The clean airframe and awesome power of the Webra GT50 give unbelievable vertical performance.



With the "D" formers in place on the inner fuselage side, the outermost right side is positioned on the formers.

CONSTRUCTION

The construction of this and everything else I build is accomplished with the aid of Pacer Technology's* Zap and Z-Poxy adhesives. I trust 'em; I like 'em; I use 'em. Nuf said!

Assemble the wing first. Before you begin, you must know which type of landing gear you plan to use. As you follow the manual, you'll notice that you're told to skip to section so-and-so for the retract version. The wing is built up—not a sheeted foam-core—and I decided to depart from the instructions and make a fully sheeted wing. I prefer to apply MonoKote* over a sheeted wing rather than an open one (just my preference). You build a right wing half and a left one over the same section of the plan; then set the dihedral and join the halves to make your wing.

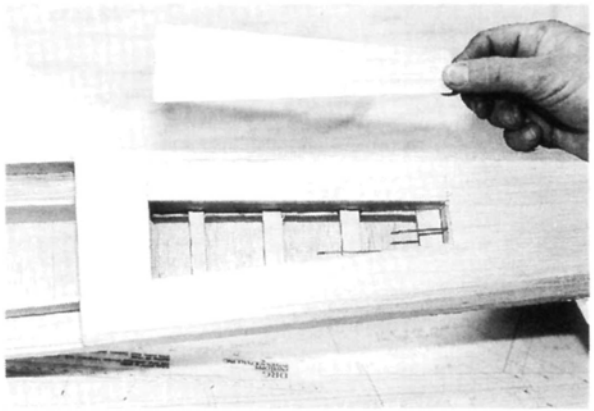
The stab and elevator assemblies are next, followed by the fin and rudder. All these are solid, hard balsa and go together very easily if you follow the plans and instructions. Small diagrams in the instructions show the edges that are to be sanded to a radius for good aerodynamics, and the positions of the hinges are marked. All the rudder and elevator controls are inside the fuselage, and that really makes a clean airframe.

It's time to assemble the fuselage, but before you start, it's very, very important that you look over the plans and really become familiar with the shape, positions and orientation of the fuselage formers. The airframe doesn't acquire its nice smooth curves through carving; it's made with octagonal bulkheads and formers. Sheeting is attached to the flats of the formers, and the edges of the sheeting are razor-planed and sanded off. This design yields a very light airframe.

There are actually two structures in the fuselage. First is the forward/inner structure, which contains the nose, the cockpit and the turtle deck. The second part of the fuselage is the rear/outer structure. It starts in front of the wings at the side inlets, establishes the outer wing saddle and continues back to create the empennage section of the airframe.

The forward/inner section is built first. As the directions tell you, carefully transfer the center lines and former locations onto the various formers and side structures. These lines become your only alignment guides as the fuselage takes form, and a little time spent here will save you a lot of time later. If you plan to install retracts, note the modifications to the appropriate formers and the addition of the 1/8-inch plywood retract floor.

When this part of the fuselage has taken shape, construct the rear/outer fuselage. The labeling of the "D" formers is critical to building the Tigershark successfully. These formers establish the rear/outer fuselage sides and empennage. Look them over closely and compare them with the plans and the parts list in the instructions. Each has a top and a bottom. *Important:* mark each one with its part number, and mark the top of each one so you can't go wrong!

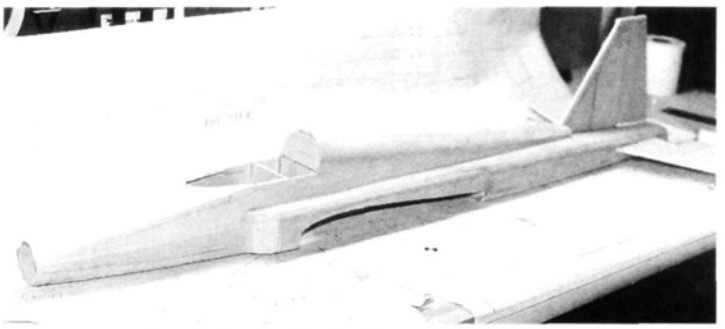


Owing to the model's long nose moment, the radio equipment is in a hatch that's behind the wings. Here, the hatch has been cut out.

Glue the D-1s, D-4s and D-6s to the outside of the forward/inner fuse. Their positions are established by using a straightedge and noting their orientation to the inner fuselage formers. Transfer the locations of the "D" formers from the plans to the 1/8-inch balsa outer/rear fuselage sides.

With the front/inner fuselage lying flat on your workbench, tape the 1/8-inch balsa rear/outer fuselage sides to the D-1s, D-4s

and D-6s. Check and double-check your measurements against the ones in the instructions. Make sure that the D-1s and D-4s are flat against your workbench. When you're satisfied that everything is correct, glue the fuselage sides to the formers. This sounds more complicated than it really is, but it is one of the most critical building steps in the kit because it establishes the incidence between the wing and the horizontal stabilizer.

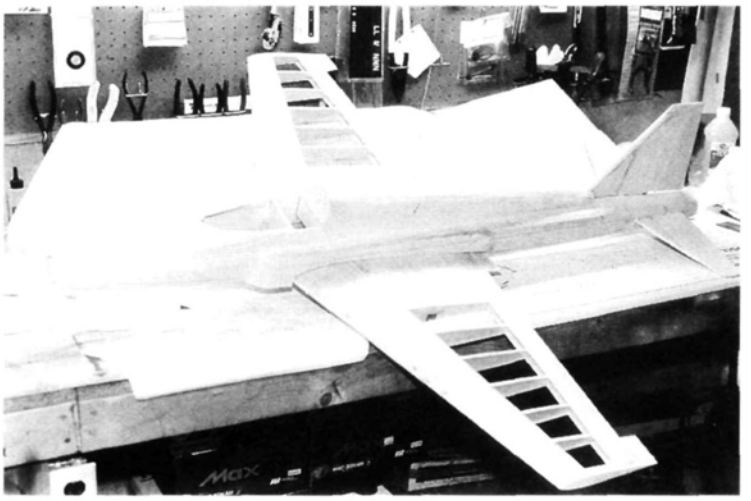


The fuselage after all the planking has been sanded to contour.

The rest of the fuselage is sheeted and sanded to contour. Install the wing and check the squareness of all the flying surfaces. Then final-sand, and you're ready for covering.

The Tigershark's long nose requires that the radio be installed in a compartment behind the wing to balance the plane fore and aft. I did not have to add any additional weight to acquire the proper fore/aft or lateral balance.

After looking at the aircraft, I decided that I would attempt to push the envelope and go for the 100mph barrier. For power, I elected to install one of Horizon Hobby Distributors* new Webra GT50s and a Mac Products* 8.5cc tuned pipe and header. This engine packs tremendous performance in a .40-size case.



The fuselage and the wing are ready for covering.

The controls are manipulated by a JR X-388S radio and JR 4131 precision servos (also from Horizon Hobby Distributors). The surface throws were all set to the maximum recommended by the manufacturer:

• Surface throws:

Ailerons—3/16 to 1/4 inch up and down.

Elevator—1/4 to 3/8 inch up and down.

Rudder—3/4 to 1 inch left and right.

To keep the airframe clean in flight, I installed Hobbico's* mechanical retracts, and I operated them with JR's 703 retract servos.

Sitting at the flight line, without fuel, my F-20 Tigershark weighs in at less than 5 3/4 pounds! Oh, and by the way—100mph? No problem!

CONCLUSION

The F-20 Tigershark kit from Direct Connection R/C is definitely a high-performance aircraft for those who feel the need for speed. In many of the kits that I've built lately, I've had to replace some of the wood, but with this kit, I didn't. All the wood was in excellent shape and well-suited to the job for which it was intended. The kit's hardware package is complete, and it's a great value (consider the cost of the items separately and the time and gas it takes to make another trip to the hobby shop).

I don't like to use the term "jet trainer." I fly ducted fans and, believe me, in my mind, no propeller-driven aircraft will prepare you for a jet. But I will say that, set up with a high-performance engine and retracts, the F-20 Tigershark sure gets you from one side of the sky to the other in a hurry. I've let several people fly it, and everyone really enjoyed the experience. So get familiar with the instructions and the plan, and dive in. See ya in the air.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

"My first scenario was a Battle of Britain reenactment in which I flew an Me-109 escort. While the clock ticked down to takeoff time, I realized my hands were literally shaking. It's an intense experience."

—Scrope

Virtual modeling—from the cockpit

B-17 bombers take off en masse to attack enemy airfields and factories. Each bomber in the Air Warrior on-line multi-player simulation is crewed by a pilot, a navigator, a bombardier and up to six gunners.

by DAVE GARWOOD

GEnie's Air Warrior

"Flying against computer enemies is like mechanical batting practice; flying head-to-head against another player is like playing catch; but flying on-line is like playing the ball game."

Last night, I flew in World War II. I flew a Supermarine Spitfire for the Royal Air Force in the Battle of the Imphal Plain, where our mission was to defend the British garrison at Imphal, Burma, against a fighter-escorted bomber attack by the Imperial Japanese Army. I laughed, I shouted, I sweated, I swore. I crashed, but I didn't die, because I flew a computer-simulated multi-player aerial battle recreation in *Air Warrior*, running on the GEnie* Network.

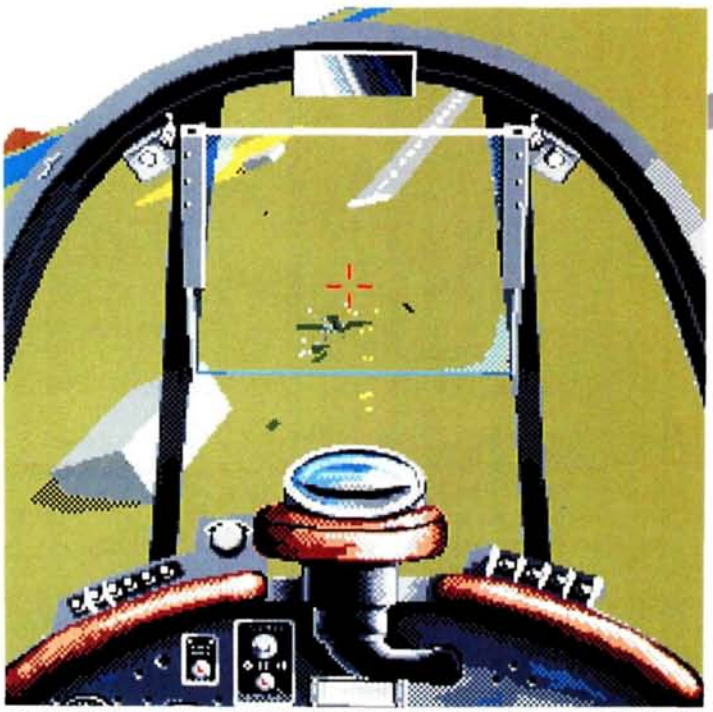
"Gordo, you fly pretty well. Next, it's time to work on your SA."

—SB—TNT Instructor Pilot

I'm a veteran of several PC flight simulators, and I've long been partial to simulated air combat, starting with the Sopwith feature of the original SubLogic *Flight Simulator*, then growing into the *Chuck Yeager's Advanced Flight Trainer*. Later, I spent time with *Flight of the Intruder, Aces of the Pacific, Secret Weapons of the Luftwaffe, A-10 Tank Killer*, and *The Red Baron*. I've flown the intricately detailed *Falcon 3.0*, experimented with the head-to-head action of *MiG 29—Deadly Adversary to Falcon 3.0* and enjoyed the richly detailed visual presentation of *Strike Commander*. This "sim" is different.

Air Warrior takes flight simulators to a new level, and it defines the state of the art in on-line, real-time, multi-player air-combat games. At the time of this writing, nothing else out there comes even close to giving the PC simulator pilot the camaraderie and the heart-pounding, adrenaline-pumping, fast-paced excitement that flying with or fighting against live human adversaries does.

Air Warrior is the creation of the Kesmai Corp.* Kesmai has been designing and developing multi-player on-line games since 1982 and makes *Stellar Emperor, Island of Kesmai, Battle Tech* and others. Multi-player *Air Warrior* is available over the GEnie on-line information service run by the General Electric Company. In addition to on-line games, GEnie provides extensive information services, including news, sports, investment information, e-mail, file transfers, bulletin boards, on-line databases and on-line discussion groups. *Model Airplane News* readers will be interested in the Modeling RoundTable*, which includes messages, files and real-time discussions of model airplanes and other hobbies.



This pilot's-eye view through the gun sight of an F4U-1 Corsair shows machine-gun hits blowing airframe pieces off a hapless enemy fighter.

A GAME YOU CAN GROW WITH

Some of the people I met on GEnie had played *Air Warrior* for four or five years. That seems to me like a long time to stick with one

"I didn't practice much off line. I signed on, headed for the nearest enemy plane and attacked. For the first month or so, I got shot down every time, with no kills to my credit. It's a complex simulation, and the learning curve is relatively long."
—Scrope

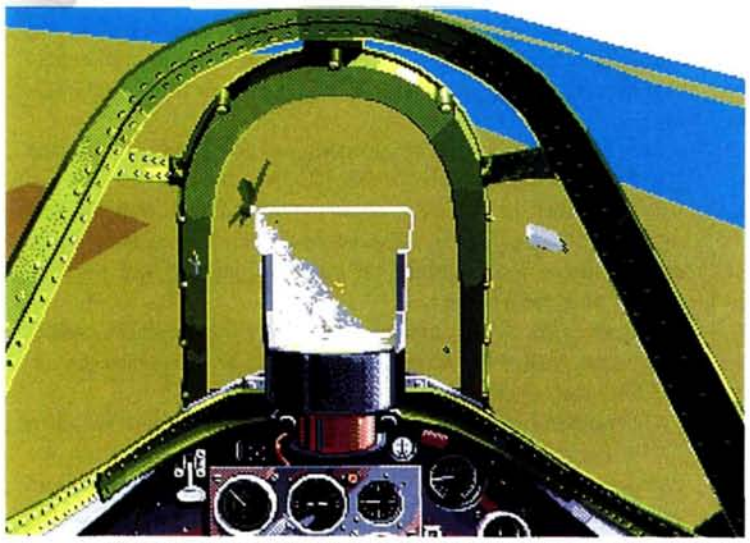
An Me-109 takes off to intercept an incoming B-17 bomber flight.

simulation, and although the human adversary element itself adds an immense amount of interest, most people can't play the same game over and over for several years. In *Air Warrior*, the playing field, the aircraft and the game itself are designed for expansion and growth.

In stand-alone mode, *Air Warrior* starts almost as an arcade game. The planes are easy to fly, ammunition is plentiful, and enemies are tame. As you gain experience, you may gradually increase the realism of the aircraft flight characteristics (allowing stalls and spins), ammo load and gun lethality, pilot's physical limitations (blackout and red-out). By the time you set these and other characteristics in the realism mode, you are flying an amazingly realistic model of a WW I, WW II, or Korean War aircraft.

In the stand-alone game, you may specify the opposing fighters and bombers, as well as friendly bombers to escort and friendly fighters as wing men. This mode develops pilot proficiency, but it's fundamentally limited: you're fighting computer drones.

In the on-line game, an arcade, or beginner's arena, is available, and it's a popular one. In addition to easy-fly planes, time is slowed, giving the novice fighter pilot more time to react to threats and to set up attacks.



A Supermarine Spitfire bears down on and chases a KI-84 Hayate. The trailing smoke indicates a fuel or oil leak on the enemy plane.

"AW players come from a couple of stocks: computer gamers looking for the ultimate challenge (thinking, unpredictable, ever-changing human opponents), aviation enthusiasts and military history buffs. This mix means that many players make contributions to the game: one accomplished player/programmer wrote a program allowing players to edit cockpit artwork; players have gone to vintage air shows to record authentic sound samples for WW II planes; others have visited military archives for copies of declassified performance data on old fighters.
—Scrope

Sooner or later, you'll move to a full-realism arena. Time is speeded up to normal, and events happen fast. The radio chatter is fast and furious, and the sky may contain 30, 40, or 50 fliers. You take off and head for the action. At first, you get shot down a lot. Gradually, you gain situational awareness ("SA" in air-combat jargon), and you may find yourself looking outside the canopy to the rear and the sides as much as out the front. Your first shots on an

Getting On Line

To connect your computer to an on-line information service, you need a modem, a communications program and a telephone line. Happily, modems cost from $25 to $300 and communications programs (1) come free with modems, (2) are available as shareware for around $50 and (3) are available as commercial software for $100 and up. You can use your existing phone line to connect to the service, but while the computer is on the line you can't make or receive voice phone calls.

Next, install the modem. There are two basic types of modem: internal and external. Internal modems require that you remove the cover of your computer and install the modem card in an open slot. After reassembling the computer, plug your phone line into the modem, and plug the modem into the wall with a cable that comes packed with it. Installing external modems saves opening the computer case, but the devices take up some desk space. The modem is connected to the computer's serial port with another cable, and the telephone cables are installed as above.

It may take a bit of fiddling to get the modem running, as there are several parameters to set. You can rely on the modem manual and the modem manufacturer's technical support service to get the modem installed and tested with the software that comes packed with it.

To make a call, you'll need to install and configure a communications software program. Often, "comm" or "terminal" programs are supplied with the modem, and almost any of them will do the job. In case you're in the market for a new one, my favorite is *Telix*, by DeltaComm Development*. It costs $39 for the program with documentation in diskette, an additional $12 for a printed manual, plus $5 shipping. A trial version of the software can be downloaded from the DeltaComm Development bulletin board system (BBS).

When your modem has been installed and the comm program has been configured, dial GEnie at 1-800-638-8369 to sign up and start your account. See the box for details on how to log in. During your first session, you'll be given local phone numbers to call to use the GEnie Modeling RoundTable and to play *Air Warrior.*

enemy are satisfying; he trails smoke, but keeps flying. Another minute of furious flying and you're on his tail again. Squeeze the trigger again and he explodes. You're credited with a victory.

With more experience, you may decide you're ready for War Night in the "one life" arena. You could be on one of two competing sides, with battle plans and prepared tactics. Fly well, because when you're shot down, you're out for the night. Read the scoring results in the morning.

"This isn't tennis. This is Darwinism."
—Blue Baron

The advanced *Air Warrior* pilot eventually moves to scenarios such as the Battle of Britain or a Korean War MiG Alley. Scenarios are written and organized by experienced *Air Warrior* players and based on historical situations. For those who signed up to fly in the Battle of Imphal Plain, a background paper was distributed, assignments were given, tactics discussed and contingency plans specified. Pilots who sign up for the scenario receive general orders and flight assignments via e-mail.

When the battle begins, the Japanese are given a 12-minute head start to simulate a surprise bombing attack. There's a steady barrage of talk among the defending forces while they wait for the signal to take off. Flight leaders give last-minute instructions. The RAF squadrons launch and fly combat air patrols. Some patrols run out of fuel before sighting the enemy; others sight the Betty bombers and Zeke fighter escorts, and the battle is joined. The first night, the defenders are victorious and receive an after-action analysis in the next day's e-mail. The simulated battle is run repeatedly for five nights, each iteration giving the sides a chance to try different strategies and tactics. In the end, this *AW* battle went to the RAF.

LEARNING AIR WARRIOR

In a program as extensive and complex as this, the new player must expect to put in some time learning the program, learning how to fly the 20 or so aircraft available and learning the features and capabilities of the on-line game in the multi-player arenas. Learning the game is not a trivial endeavor, but there's plenty of help available.

First, you can play alone against your own computer. The *Air Warrior* software includes the flight models for fighters and bombers, ground terrain covering three hypothetical countries and computer enemies. You can download older software versions for the IBM PC, Macintosh Color and Amiga, and you can order a flight manual on-line from GEnie. An alternative for PC users is to head to their local software dealer and buy the boxed version of *SVGA Air Warrior*, which includes software on diskette and a manual. (This is the advanced version featured in this article.)

Second, when connected by phone line using modems, you can practice head to head against a single live opponent. This might be a way to get some battle experience with a live opponent at low-connect-time costs, particularly if you can connect your opponent with a local phone call.

Third, Tuesday Night Training (TNT) sessions are held weekly on GEnie at 9 p.m. Eastern time. Conducted by *Air Warrior* aces, these sessions include questions and answers, discussions and supervised flight time.

Fourth, for a special price that includes reduced-cost on-line time and reduced-cost maps and manuals, the on-line Air Warrior Training Academy (AWTA) offers a series of seven, two-hour lessons that include classroom instruction and supervised flying time, plus a critique of gun camera films made during your practice sessions.

The skills you'll need to succeed and the topics taught in the AWTA include (quoted from the AWTA syllabus):

- **Basic concepts.** The *Air Warrior* environment, terrains, figuring out who you, your friends and your enemies are, basic radio use and lingo, understanding the radar display and how to make contact with the enemy.
- **The aircraft.** A comprehensive tour of the available fighter and bomber aircraft, what their strengths and weaknesses are and how they are best used.
- **Air combat maneuvering (ACM).** The science and the art of ACM, constrained to those factors that are present within *Air Warrior*. We'll talk about various maneuvers, when to use them and what their inevitable side effects are.
- **Gunnery.** An in-depth explanation of how machine guns and cannons are modeled in *Air Warrior*. We'll cover how to figure

Bombing Mission

by Chris "Scrope" Zibart

In addition to fighter aircraft, *Air Warrior* models several bombers, such as the A-26B Invader and the B-17G Flying Fortress, which are used in the game to attack tactical targets like enemy airfields, radar installations, AAA gun emplacements, fuel depots, ammo dumps and aircraft hangars; as well as strategic targets that include factories and refineries.

Eight crew positions are available in the *Air Warrior* B-17: pilot (who, in this simulation, doubles as bombardier), navigator (a non-functional position; he can take over for a gunner who gets shot; we usually use that spot for an observer or taunter of enemies on the radio), chin turret, upper turret, ball (bottom) turret, left waist, right waist and tail gunner. Skilled gunners will often save a bomber mission. In scenarios, bombers will often fly as a group, requiring significant coordination and planning.

Here's how it works in the main arena: typically, you're in a briefing room, and you see, say, Black Hawk, tail number 4642, a bomber pilot. He says, "Hi, Gordo; want to gun a bomber with us?"

You type </status 4642> and see what positions are still open. You select an open position, and reply by typing, for example, </join 4642 ball>.

He types </accept 5506>, and you're in the ball turret.

When he takes off, you and all his other gunners get dragged along with him. Assuming the airplane is not full of people, you'll be able to move around to different positions in flight.

When I was new, I found that signing on as a gunner is a great way to meet people and see what the game is about without having to know much about flying and dog fighting!

lead properly, show you how to estimate your ammo lethality in real time and disclose a few little-known facts about how the guns really work.

• **Communications.** Radio-channel organization, its relation to the intercom and the various bits of shorthand and jargon that make for less typing and more clarity.

• **Radar**. A description of the use and limitations of the radar display, with a discussion of modes, range, update rate, target count limits and the altitude floor.

• **Using bombers effectively.** An entirely different discipline, crewing and flying bombers requires a lot of planning and precision to be effective. We'll discuss the selection of targets, ingress altitude, choosing the right ordnance and the tradeoffs between using friends as gunners or escorting fighters.

• **Capturing airfields.** "Prepping the field" means destroying that field's command and control tower, and pulverizing the triple-A batteries (anti-aircraft artillery). This must be done before the C-47 Gooney Bird makes its visit with paratroopers, or the field can't be taken. We'll talk about the various time limits involved with field capture and discuss several ways to accomplish this task.

• **Aircraft-carrier ops.** Operating from an aircraft carrier poses a few interesting problems, not the least of which is landing! We'll cover how to set up an easy approach and how to take off with varying bomb loads without crashing.

• **Ground vehicles.** Along with aircraft, *Air Warrior* supports a handful of ground vehicles. These behave very differently from the aircraft, although some of the commands to operate them are similar. We'll talk about the purpose of each vehicle and what that means to the unwary pilot.

CONCLUSION

The price of on-line services is like blade-type shavers: the razor is cheap, so it's the blade sales that keep the company in business. Older versions of the *Air Warrior* software are free if you download it. GEnie costs $8.95 per month (this includes four hours of no-charge connect time). After that, GEnie charges $3 per hour for 2,400-baud on-line connect time during "non-prime" hours (6 p.m. to 6 a.m. on weekdays, weekends and holidays). The monthly fee includes the first four hours of connect time. Note that *Air Warrior* is designed to play at 2,400 baud, so there's no penalty for using an older modem.

When you sign up and log on, you'll get to play the most impressive air-combat simulator game available today. You will fly with wingmates and fight against human enemies in a way that makes your heart pound and your palms sweat like no other computer game.

GEnie is offering a favorable rate for new users: free for the first 14 hours. When you decide to try the GEnie service, stop by the Modeling RoundTable and introduce yourself. Say you're a *Model Airplane News* reader, and tell us what your modeling and computer gaming interests are. Then go over to the *Air Warrior* arena.

My GEnie e-mail address is D.GARWOOD. My *Air Warrior* radio call sign is Gordo. See you in the unfriendly skies!

Addresses are listed alphabetically in the Index of Manufacturers on page 137. ■

Special offer for new users from GEnie

GEnie, through the Modeling RoundTable, has extended a special offer to new users who are *Model Airplane News* readers. GEnie will waive the first month's $8.95 fee and give 14 hours of non-prime on-line time, which normally costs $3 per hour. For those who sign on and use all their free time, this offer is worth $50.95.

To sign up on GEnie, follow these steps:

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2. Dial toll-free in the U.S.—1-800-638-8369 (in Canada, 1-800-387-8330). Upon connection, type HHH. (Please note that every time you use GEnie, you must enter HHH upon connection.)

3. At the U#= prompt, type JOINGENIE and press <RETURN>.

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For more information, call 1-800-638-9636.

PART 3

Biplane Secrets

by CARL RISTEEN

Triplanes, monoplane comparison, knife-edge tips and more

PART ONE OF this article (see the June '94 issue) briefly covered the evolution of airplanes and how it led to biplanes, with their problem of mutual wing interference and methods to combat it. Also covered were the effects of stagger, decalage, wing flaps and incidence. Part 2 (July '94) covered further performance-enhancing refinements and offered a schematic for a "cheater" interplane strut that improves performance and reduces tip losses. In this issue, I'll look at triplanes, compare and contrast monoplanes and biplanes, comment on bipe fun-fly designs and fly through some of the most important points worth remembering.

Peter McDermott's 78-inch-span, ¼-scale Sopwith triplane took first at the '92 FAI Scale Internats in Muncie, IN. It's powered by a Laser 180 twin that spins an 18x6 Dynathrust prop.*

IF TWO WINGS ARE GOOD, WHY STOP THERE?

The Sopwith triplane fighter burst upon the scene in 1916, immediately racking up a tremendous record in aerial combat. It was probably close to the optimum in triplane design for its time, and it precipitated a blizzard of imitators. The best known of these was the innovative, tricky-handling Fokker DR-1—one of the first multiplanes to seize the bracing-wire-eliminating advantage of thick wings. It was immortalized by the formidable von Richthofen.

Convinced that Stanley Sopwith had discovered something profound, less talented designers jumped on the multiwing bandwagon. Three wings had clobbered the two-wing opposition, so why not add another wing or two? They didn't realize that most of the Sopwith tripe's success was rooted, not in three wings, but in brilliant design.

Brief forays into quadruplanes (four wings) and even pentaplanes (five wings) were rewarded with little success. The ultimate folly in this pile-on-more-wings aeronautical dead end was probably the enormous, 100-passenger, eight-engine, Caproni Ca 60 Transaero seaplane of 1921. It literally bristled with wings, nine in all, arranged in tandem along the fuselage in three triplane groups. With so many wings competing for much the same air, it was a complete flop.

By dint of Titanic effort, it struggled a few feet above beautiful Lake Maggiore before stalling and frightening many fish. It burned before it could be repaired, reducing the anxiety of both pilots and fish.

By the early 1920s, triplanes were largely extinct because this more complex layout had little, if any, aerodynamic advantage over the biplane. Structural benefit was minor, in contrast with that of the biplane over the monoplane. A triplane of reasonable overall height can carry only a few percent more wing area within a given wingspan before induced drag exceeds that of the bipe. The middle wing, under aerodynamic assault on two fronts by the upper and lower wings struggles to develop a maximum of about 30 percent of an equal-wing tripe's total lift.

The Sopwith tripe's clever designers used a relatively high wing-aspect ratio of over 9, with a gap about equal to the chord. As a consequence, it suffered little, if any, induced drag beyond that of most contemporary biplane fighters that had wings with much lower aspect ratios. Revolutionary streamlined bracing wires chopped parasite drag. Its six ailerons needed relatively light stick forces to produce an excellent roll rate and superb handling.

A later Sopwith triplane fighter, the Snark, took a big step backward to much lower aspect ratio wings and was much inferior in handling. With the same wingspan as the earlier tripe, it was only slightly faster, even with more than double the horsepower.

I must confess to being a closet triplane fancier, with a stand-off-scale Sopwith tripe designed but not yet built. At the flying field, a tripe will instantly upstage just about everything, even the haughty bipes. Anyone for an aerobatic, tapered-wing sport tripe?

BIPE vs. MONOPLANE. WHICH IS BETTER?

Unless we are hung up on biplanes, why not simply slash the upper wing off a bipe and fit a new, larger, lower wing with roughly the same total area? Since there appears to be minimal structural weight advantage associated with wire bracing of a model bipe with thick, symmetrical-section wings, is there any good reason to use two wings at all? True biplane aficionados will, of course, condemn such drivel as blatant heresy, but here goes:

In theory, two wings, each of the same design and shape but half the area of a larger single wing, can be built to a total structural weight of only 71 percent of that of the larger wing. The necessary cabane and interplane struts will reduce the weight advantage somewhat, but the monoplane will need a longer, and thus heavier, fuselage to get the same stability and controllability. The monoplane's weight will be increased still further by the additional structure needed in the wing to provide the torsional stiffness that the biplane's wings get from the interplane struts.

The monoplane can use a lower-aspect-ratio wing than the biplane, as it does not suffer from mutual wing interference—a point in the monoplane's favor. The longer-wing monoplane will demand more aileron area to achieve the biplane's roll rate, and it will need roughly double the aileron servo effort—a minus point. The monoplane will have more mass farther from its center of gravity. This will increase its mass moment of inertia and thus slow its initial response to control-force input—another minus, at least for barnstorming-type flying.

After mulling over the monoplane-versus-biplane question, I decided that the only way to settle the issue would be to build an upstart monoplane with aspirations to bipe-like performance.

I lifted the fuselage design from one of my bipes and built a single wing with 95 percent of the total area of the previous bipe, using the bipe wing's structural design, with aspect ratio lowered by about 25 percent. The lower aspect ratio provided the additional torsional stiffness needed in the absence of interplane struts. The wing received detachable vertical fins—an experiment directed at recovering the lateral area that was lost along with the cabane and interplane struts.

The very large ailerons needed to match the bipe's roll rate would require two large, heavy servos. Figuring that the beast would win few beauty contests anyway, I equipped its ailerons with very effective, but ungainly, paddle-type aerodynamic balancers. With their assistance, one standard servo did the job. The result was a monoplane whose appearance, like Quasimodo's, might most charitably be described as distinctive. Despite its greater weight, it turns as tightly as the bipe, but that's about all. The slightly higher Reynolds number and lack of biplane mutual wing interference help lift a bit. It has little of the bipe's strong knife-edge capability, even with the ugly auxiliary wing fins in place. Sadly, I realized that I had not succeeded in fooling nature. A piped Webra* 120 propels the 8-pound gene-spliced hybrid like a tiger with its tail on fire, but it is no bipe.

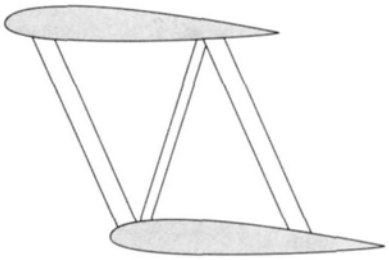
Bipe and monoplane; they're birds of different breeds and instinctive temperaments, and never the twain shall meet. Aerodynamic efficiency favors the monoplane, at some cost to barnstorming-type maneuverability. For precise, competition, pattern-type flying with large-radius, high-speed maneuvers, the monoplane layout is probably superior. For those with a bent toward exuberant, let-it-all-hang-out aerobatic hot-dogging, a well-designed, lightweight, high-powered bipe is hard to beat.

BIPE PATTERN MODELS?

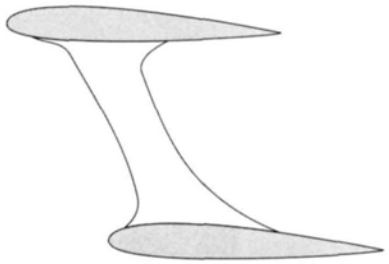
Scrupulous attention to drag-reducing detailing can produce a bipe that is nearly as fast and (making some allowance for its shorter wingspan and fuselage) as precise as a monoplane pattern model, while retaining the bipe's entertaining hot-dogging character. Lengthen the bipe's fuselage to that of a monoplane pattern model of the same wing area and power, stretch and narrow its wings to an aspect ratio in the 8 to 10 region, and the bipe pattern model should be very close to the monoplane in smoothness and precision (although losing much of its delightful barnstorming character). Use of higher-aspect-ratio wings will also permit the lowering of the upper wing. Pulling the centers of gravity and drag down closer to the thrust line tends to boost aerobatic precision.

Frankly, current pattern rules offer little incentive to use biplanes. If the rules dictated a tighter routine, flown closer than half a county away, with more emphasis on knife-edge maneuvers, bipes could emerge as very scrappy contenders. As any air-show Barnum knows, spectators salivate over bipes like a jamboree of Cub Scouts greeting the pizza truck.

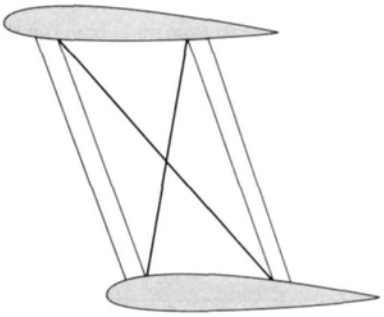
Interplane strut types



Basic N-strut
Members should be well-streamlined. Used on many full-scale bipes.



Unitized streamlined strut
Used on numerous, present-day, full-scale, aerobatic bipes. May be made of ¼-inch sheet balsa for models with .60 to 1.20 engines. Low drag and additional lateral area improve knife-edge and handling.

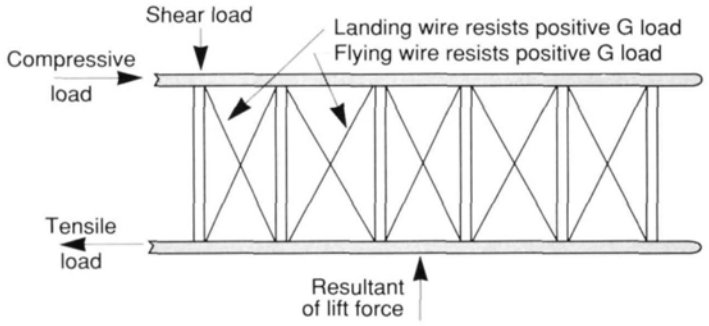


Wire-braced strut
Used on many older full-scale bipes

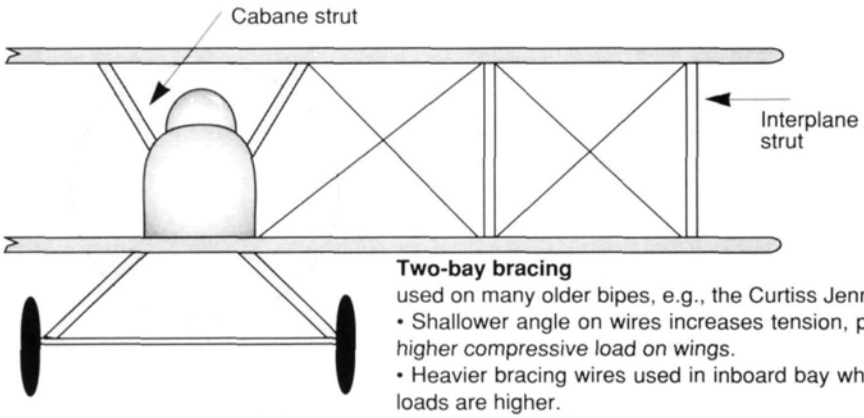
BIPE COMPETITION FUN-FLY MODELS?

One currently white-hot competitive arena that bipes just might shine in is competition fun flying. Looping as quickly as possible dictates a very low wing loading. Rolling at a rate that threatens to fling the wingtips into orbit is also very important, but this tends to impose a rather strict limit on wingspan. Increasing the wingspan will reduce induced drag and tend to produce quicker loops, but roll rate will suffer. Increasing the wing chord while retaining the existing span will

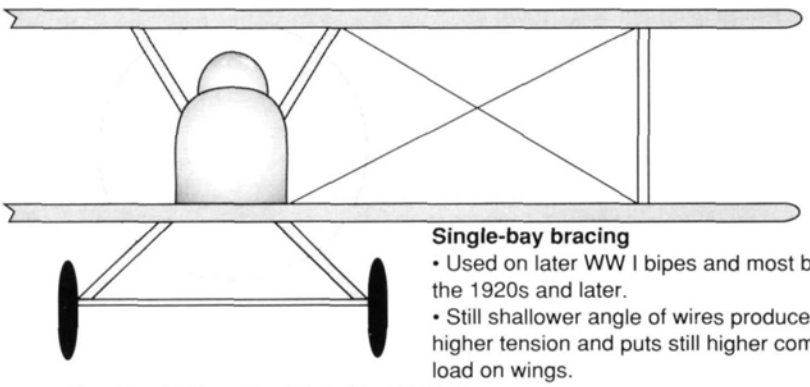
Progression of biplane wing bracing



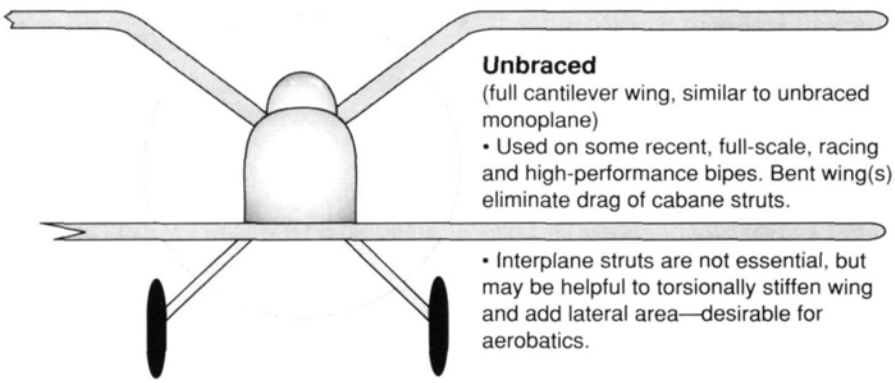
Multi-bay
used on very early bipes and WW I bombers; minimizes unsupported wing length—necessary for very thin wings favored in very early days. Wire bracing unites two wings in a rigid truss—very strong and light. Little bending moment in wings; lift moment is resisted by two vertically widely spaced forces. It's a very efficient structure: steep angle of wires keeps wire loads low and reduces wire-induced load on wing structure, but also causes high drag.



Two-bay bracing
used on many older bipes, e.g., the Curtiss Jenny.
- Shallower angle on wires increases tension, puts higher compressive load on wings.
- Heavier bracing wires used in inboard bay where loads are higher.
- Longer, unsupported wingspan requires stronger, thicker wings.
- Lower drag than multi-bay, but heavier structure.



Single-bay bracing
- Used on later WW I bipes and most bipes of the 1920s and later.
- Still shallower angle of wires produces still higher tension and puts still higher compressive load on wings.
- Needs still stronger, stiffer wing structure.
- Good with thicker wing sections.



Unbraced
(full cantilever wing, similar to unbraced monoplane)
- Used on some recent, full-scale, racing and high-performance bipes. Bent wing(s) eliminate drag of cabane struts.
- Interplane struts are not essential, but may be helpful to torsionally stiffen wing and add lateral area—desirable for aerobatics.

BIPLANE SECRETS

produce tighter loops, but the additional drag may slow the model so much that loops are only slightly quicker, and quickness is what counts.

Adopting a biplane layout would permit the use of considerably more wing area within a given wingspan without increasing induced drag. Result: quicker loops—without hurting roll rate—and a greatly reduced demand for servo torque—so saving all-important weight. The aerodynamic potential looks intriguing, but structural complexity will tend to dampen bipe fun-flier enthusiasm. My own bipe designs have successfully duked it out with many monoplanes in sport fun-fly competition. Generous lateral area and low wing loading lets you get away with murder without scattering divots on the flying field.

KNIFE-EDGE HINTS AND KINKS

The high-powered sport bipe with a big rudder is king of the knife-edge hill. The two wings tend to trap air against the fuselage sides and interplane struts and produce a lot of knife-edge lift. The shorter fuselage places the rudder in stronger propwash for powerful yaw control. Well-streamlined interplane struts with significant lateral area (similar to those used on some full-scale aerobatic designs) can provide a lot of knife-edge lift assistance. A devious schemer at heart, I often augment this by using airfoil-sectioned N-brace interplane struts that are actually little, clear-plastic-film-covered wings (see Part 2, in the July '94 issue). Majestic, horizon-to-horizon, slow rolls can be performed with very little rudder input and almost imperceptible yaw. With enough power, knife-edge square loops and even vertical square eights become easy. These "cheater" struts also seem to act as flow fences to reduce induced drag while enhancing lateral stability and controllability. Bipes with low effective wing-aspect ratios can use all the help they can get to reduce tip loss.

With a well-designed, lightly wing-loaded bipe, you can achieve remarkable knife-edge performance. Holding a full 45 degrees deflection of a large rudder while in knife-edge, power off, results in a nose-level descent, thanks to the cheater struts. Put some power on, and the descent stops, with the model crawling along at well under 10mph in knife-edge. The sub-fin and sub-rudder area help by placing the maximum possible rudder area in the propwash.

In giving further vent to my scheming nature, I have played around with other trick devices to boost knife-edge flight.

Clear-plastic-film-covered cabanes with their own rudders almost halve knife-edge loop diameter (they move in opposition to the rear rudder, analogous to coupled flaps and elevators), although the model starts to look a little weird. Interestingly, everything I have tried to augment knife-edge has also improved overall handling and resistance to stall/snap roll by increasing yaw resistance. NASA proved, by R/C model experiments, that strategically positioned additional lateral area improved the stall/spin resistance of several common full-scale aircraft.

Keep it light, and your bipe will reward you with many happy hours of error-forgiving aerobatics that may sometimes leave you wondering if the laws of physics were temporarily suspended for your flying layer cake.

BIPE TAIL FEATHERS

The airflow over a bipe's tail surfaces tends to be considerably more disturbed than that of a monoplane, particularly if the fuselage is somewhat dirty aerodynamically. To compensate, bipes need more tail area, particularly in the fin and rudder. Considerably enlarging the vertical tail can greatly help many a sloppy-handling bipe. I like to use vertical and horizontal tails having about 10 and 20 percent, respectively, of the wing area. Many of the common, scale-like designs currently available fall considerably short here, in my opinion. The Ultimate is a good example of a bipe with the kind of vertical tail area needed for superb lateral controllability. I would love to try an Ultimate retrofitted with longer, tapered wings to cut induced drag and make it less power-hungry.

This is the author's attempt to build a monoplane that performs like a bipe: 86-inch span; 1,230-square-inch wing; 8 pounds; all-moving vertical tail; spoilers; balloon-tire retracts; and paddle balancers on ailerons. The plane is currently powered by a piped Webra 120.

SUMMING UP

I find bipes friendlier when their wing loading is kept considerably lower, say 65 to 75 percent of that of an equivalent monoplane (no chore, with a well-designed bipe). Aspect ratio also enters this equation; higher-aspect-ratio bipe wings can happily shoulder a higher loading. Low wing loading helps a lot to more than make up for the higher parasite and induced drag of most bipes. Some of the smaller kit designs are short of the mark here and tend to fly on the engine. In my book, at a low power setting, a good bipe flies buoyantly with excellent control, and at high power, it flies spectacularly. A bipe will feel overweight at a wing and power loading that would be quite acceptable in a monoplane.

One very helpful guide is the concept of span loading. For a given amount of lift, induced drag is inversely proportional to the square of the wingspan. Increasing the wingspan by 10 percent will reduce induced drag by 19 percent, regardless of the chord, as long as the wing isn't stalled. A little extra wingspan is worth a lot in induced-drag reduction.

A biplane typically needs 85 to 90 percent of the wingspan of a monoplane to have the same induced drag as a monoplane of the same weight. Short-wing bipes must be built light. Desirable weight at a 48-inch span is well under 4 pounds, say 5 pounds maximum. Cut wingspan to 44 inches, and weight should be cut to about 3 pounds, say 4 pounds maximum, or performance will be substandard.

A little extra weight takes a lot of additional power to overcome, i.e., to recover lost flyability. A good rule of thumb, I think, is 25 percent more power for 10 percent more weight. Keep it light, and your bipe will reward you with many happy hours of error-forgiving aerobatics that may sometimes leave you wondering if the laws of physics were temporarily suspended for your flying layer cake.

I hope you have enjoyed my discussion of biplanes. If you would like more on the subject (and there's a lot more to the story!), please write to me c/o *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. Happy landings!

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

GOLDEN AGE OF R/C

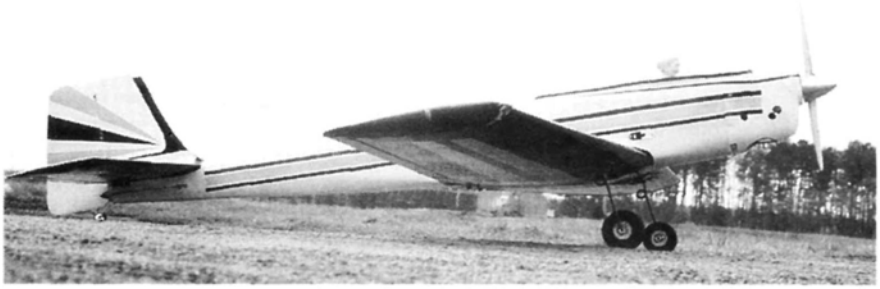
HAL DeBOLT

NEW ENGLAND MODELING MAGIC

MANY OF YOU have written to say that you'd like to know how various areas in the country became hotbeds of R/C aviation. Los Angeles, Chicago, Detroit, Buffalo, New Jersey, D.C., the Carolinas and New England are often mentioned. I remember some of them, but I need info on and photos of others. Can anyone help?

EARLY NEW ENGLAND ACTIVITY

Fortunately, I have an informative letter on early activity in New England from old friend John Ross of Needham, MA. Remember this was Lou Andrews, Ernie Huber and Bob Elliott country (among others)? I knew something of the early happenings in New England because my Navy modeler buddy Harvey Thomasian is a Yankee. (We're still in touch, and I'm happy to say that Harv is very active.)

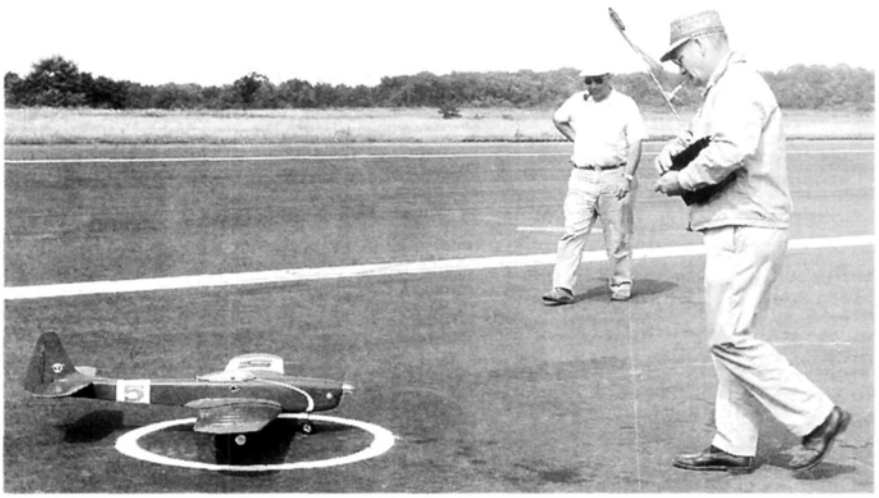


John Ross combined one of the first fiberglass fuselages by Dwight Hartman (Interceptor) with a Prettner Supra Fly wing to create a Supra-Ceptor; says it performs well!

to an early start. Harvey could claim he flew the *first* LW Senior kit, and we watched Elliott with his Rockwood-equipped Schneider Cub and Andrews with his Trixter Beam. Surely there must have been others?

When R/C competition blossomed, Eastern modelers all had "must attend" events. As well as the Nats, the list included the NYS Champs (Rochester), the Wright Brothers Memorial (Dayton, OH), the Detroit Invitational, the Canadian Nats and the Aero Guidance Society Annual. (There were other, less important events, too.) A contest that definitely ranked high was the annual New England Championship; although it was nearly a 500-mile trip for me, that never put me off attending!

I think you'll agree that all successful activities rely on having someone who goes out of his or her way to promote them and ensure that they run smoothly. Early New England activity owes John Ross and others for their efforts.



At an early New England Championship, pioneer Harvey Thomasian guides Hal deBolt with his Interceptor V into the taxi-back circle.

In the pre-citizens-band era, like most other places, New England lagged behind the Jersey, Pittsburgh and D.C. areas, but when CB took off, so did activity in New England and elsewhere. Thomasian, Andrews (Guillow-Andrews Models) and Elliott (E-K fame) were off

John says his first attempt at R/C was with a Berkely Super Buccaneer that had Aerotrol equipment that he never managed to sort out. He switched to a C-S 465-equipped Foxworthy short wave, but he soon lost it! Eventually, a LW Trainer with a Kraft single-channel system brought him the success he deserved and continued to enjoy. Until a Logictrol at last brought him into the modern era, he ran the gamut of systems from cascaded escapements to Sampey propo and even a TTPW.

The New England Championship, which John inspired and guided from 1954 to 1972, was the crown jewel of Yankee R/C. They were fortunate to find a little-used airfield in a beautiful valley in Orange, MA; it was ideal for a large R/C contest. As the years rolled by, the event grew in stature and attracted such well-known contestants as Walt Good, Howard McEntee, Phil Kraft, Tony Bonetti, John Roth and Canada's Ron Chapman (my cohort in those days). The names inscribed on the winner's trophy

represented the who's who of New England R/C—Phil D'Ostilio, Pete Lambert, Bob Elliott, Jerry Wagner, Joe Martin, Pete Reed, Dennis Sawyer, Ernie Huber, Harvey Thomasian and me. Most of us were perennial attendees.

These early meets were especially attractive because they always included all the R/C classes that we had then—everything from single-channel to AMA pylon; none was overlooked.

Former national CL stunt competitor Dave Gierke helps Hal deBolt with his Goodyear Class entry at an early New England Championship. The Goodyear Class was the forerunner of Formula 1, and original designs were allowed (hence the "deBolt special").

OUTSTANDING STANDING!

Some New Englanders were outstanding. Ernie Huber designed, built and flew one of the first R/C helicopters and later gained recognition for his movie 'copter flying (most realistic).

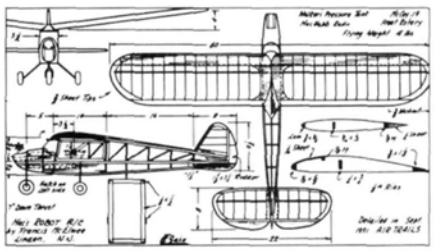
New Hampshire's Harrison Morgan became one of the country's most accomplished single-channel fliers. He started with a LW Super Cub and was soon very adept at maneuvers. As he progressed, he added engine control and modified the Cub so that it became a "one-speed" aircraft, so to speak. With this altered force arrangement, normal flight was at partial throttle; when full power was applied, the craft looped automatically. To accomplish the various maneuvers, he simply changed power. Along the way, he modified the Cub until it was hard to tell what he had started with! I'm very sorry to say that Harrison Morgan is another fine modeler we no longer have; an innovator and a fine gentleman, he is sadly missed.

PYLON PROMOTION

When pylon racing grew, it was promoted in New England, where there was soon a racing circuit. Its heyday was during the time of

Evaluating R/C Planes

While control systems were being developed, early R/C'ers naturally emphasized electronics. Considering that we started from scratch—developing items such as a transmitter, receivers, actuators, batteries and seemingly mundane items like switches, connectors and wiring—there was much to be accomplished! Then, when a system seemed usable, the proof of the pudding could only come with flight. Of course, we were eager to fly, and the logical, fastest way to do it was to use a proven plane, so the converted free-flights were obvious choices.

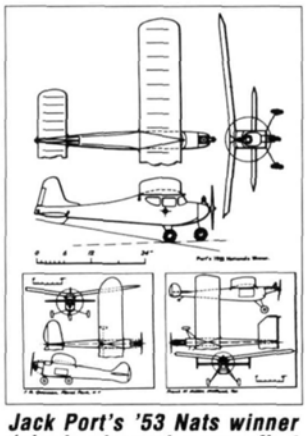


McElwee's Robot was one of the "interim" designs; it came between the converted free-flights and the R/Cs of today. The modern appearance of these designs belies their flight envelope, which was more typical of the period.

As the electronics people began to offer usable systems, modelers were enticed into trying R/C, but they soon discovered that experience with the free-flights wasn't especially suited to R/C. With the electronics work done, they had time to give the aircraft their attention. Soon, we had the beginning of what we know as R/C aircraft.

People such as Howard McEntee, Gene Foxworthy, Mike Graniere, Jack Port and Fran McElwee soon had craft flying, and they were several steps forward from the free-flights. McElwee's Robot was typical: let's dissect it to see how the changes started. Note that Fran continued to use the free-flight-style structure, but it was much more robust. (The need for strength had become apparent!)

Despite the weight of the C-S 465 radio, the 5-foot-span model weighed only 4 pounds. They didn't have the courage to depart from the free-flight force arrangements because significan't downthrust was needed to keep the free-flight climbing tendency under control Otherwise, you have to admit that these early R/C planes were beginning to take on a modern look, and the Robot was widely modeled.



Jack Port's '53 Nats winner (single-channel versus first multis) shows the pleasing lines the last of the rudder-only designs displayed.

Next time, the design that opened the door to modern R/C planes: Walt Good's famous Rudder Bug.

Formula I and II, when the area's competitions were as good as you'd find anywhere, and I think there's still sport-pylon activity there today.

As you might suspect, Connecticut is densely populated and short on space for flying sites, and for Formula I-type racing, you need a decent flying field. Just as in the wartime Navy, when you made do with what you had, so have the New Englanders made the most of the space available to them. At Granby, they had no qualms about racing out of what most would call a pea patch! There was obviously room for a course, but no space for a landing area. You took off and landed on the course! Other sites were apparently similar; on the back leg of one course, you flew over the river—such desire and dedication!

It's amazing that some of the country's finest racing was done on the Northeast circuit. Modelers went there from New York (even Buffalo) and New Jersey to fly in Formula I and II. And the competition was fierce; at Granby, you really knew you were in a race!

Naturally, New England provided most of the competitors—excellent modelers such as Jerry Wagner, Pete Reed and Mike Helsel, to name a few. Clubs usually staged two races each year, and the club leaders made it all happen over the years. At Granby, Burt and Bernice Williams filled this role; they were excellent modelers and hosts who made sure the operation ran smoothly and *fairly*.

Just as John Ross's group promoted pattern flying, so did the circuit do as much to popularize pylon racing. I greatly enjoyed flying with both groups! John Ross has promised us some interesting photos of early New England activity (sounds great!).

Well, now I'd like you to read my first paragraph again; readers would enjoy knowing how things were in *your* area, too! ■

CENTER ON LIFT

MICHAEL LACHOWSKI

F3J HAND-TOWING

I'VE MENTIONED F3J hand-towing in past columns. This month, I want to tell you about a recent three-day F3J contest organized by Frank Weston and Weston Aerodesign Co.* (WACO). Everyone enjoyed it, and I'll share some of the things we learned about the type of equipment and sailplanes needed to cover the wide variety of weather conditions during the contest.

If you've never tried F3J, you're missing one of the purest thermal events out there. If you assume you can get 4 minutes from a launch without lift, the 10 minutes of working time for launching and flying will leave you at least 5 to 6 minutes of thermalling. Compare this with a winch launch, from which you can get 4 to 5 minutes in the absence of lift. In a conventional, 7-minute, AMA-type contest, you need only 2 minutes of thermalling. So you can see, F3J demands topnotch thermal flying skills.

Tony Matyi spots for Bill Miller during the contest. Note the two stopwatches—one to keep track of working time and the other for flight time.

During the winter snowstorms, I was looking forward to this event because it was to be held in Hilton Head, SC. Even more exciting was the collection of pilots planning to attend. On the West Coast, pilots will recognize names such as Joe Wurts and Ben Clerx and on the East Coast, top Eastern Soaring League pilots, including Josh Glaab, Tom Kiesling and me. On the international scene, European F3J champion Stefan Eder from Germany attended.

PHOTOS BY SUSANNAH ANDERSON

Stefan Eder launching a Magic for Klaus Bungeroth. A good release helps the tow man to maintain constant tension at the start of the launch.

The contest featured the F3J soaring format with six rounds each day. The winner was the pilot who had the best total score after three days. Daily prizes were awarded to the flyoff winners, but flyoffs were not counted for the three-day total. The polo field at Rose Hill Plantation proved to be an excellent flying site.

Many of us arrived on Wednesday or Thursday for individual practice as well as a three-round practice contest (Thursday) to work out any problems with equipment or with running the contest, which started on Friday at 9 a.m. A pilot matrix with four flight groups provided everyone with an opportunity to fly against most of the other pilots several times each day. With a 5-minute prep time plus 10 minutes of working time, each round required one hour. Friday was warm; there was a good breeze that became stronger through the day, and there were plenty of thermals. Quick launches and 100-point spot landings were common. After a throw-out round, Team East (Mike Lachowski) was leading, flying a 130-inch Grand Prix original design, closely followed by Team Wurts, flying a Falcon.

The winner of the two flyoff rounds, rewarded with a WACO Magic kit, was Team VA Tech (Tom Kiesling), followed by F3J Bavaria 1 (Stefan Eder) and then Team Wurts. I think Joe enjoyed his prize the most—a full-size sailplane flight provided by Solaire.

LAUNCHING

With the wind conditions and thermal activity, afternoon flights required ballast. These conditions provided an interesting comparison of launching technique. The field was split between pilots using a pulley and those using straight tows. In the wind, the straight tows provided some height advantage and were about as quick as pulley tows. All of the top pilots used straight tows and ballast. Winning rounds with times over 9:45 and 100-point landings were common.

Day two brought light winds and weak lift. In these conditions, the WACO Magics showed their strengths. Team Wurts topped the field and moved into first place overall. Close behind was Glaab and Glaab, flying a Magic. Except for the top two pilots this

Is it really that windy, Joe? When flying with ballast, you need a strong throw.

day, most other pilots suffered some serious defeats under these conditions. There were plenty of 700 to 800 round scores and even some lower scores in the end. In the 15-minute flyoff rounds, Magics were on top: Josh Glaab in first, followed by the M&Ms with pilot Bill Miller and Team Tidewater with pilot Herk Stokley.

Pulley tows were effective in the light wind. If the conditions were right, straight tows were good, but you needed a strong runner to get a good launch. All the exercise was starting to take its toll on the field. Almost everyone attending the contest was flying; everyone was timing, towing, or piloting three out of four rounds and sometimes every round. In some rounds, all three pilots working together were flying, so you had to pick up some other timers and tow men. The ideal situation would be three-pilot teams—with none of the pilots on a given team flying against one another—and a team manager to keep track of logistics.

The forecast for day three called for 15 to 25mph winds and clearing through the day. The air was very unstable and, at times, there was strong lift. Multiple thermals were needed to max a flight, and larger airplanes could stick with thermals farther downwind. While a few pilots damaged airplanes the first day, the strong winds on Sunday produced much carnage.

The launch area is busy at the start of a round. Runners typically start running 4 to 5 seconds before the start of the launch window so pilots can launch right at the start.

Team Wurts did it again, flying a heavily ballasted Falcon during most flights and destroying a Thermal Eagle on launch in the last round for a throw out. Team East was second, destroying the Grand Prix in the fifth round. I finished the day, flying an F3B/Unlimited model with a few pounds of ballast added. There were other notable problems caused by the strong winds; one of the Germans' aileron linkages disconnected because of aileron flutter on launch, and Ben Clerx's Mako experienced a wing failure. Until then, Ben was working his way up in the overall standings.

RESULTS

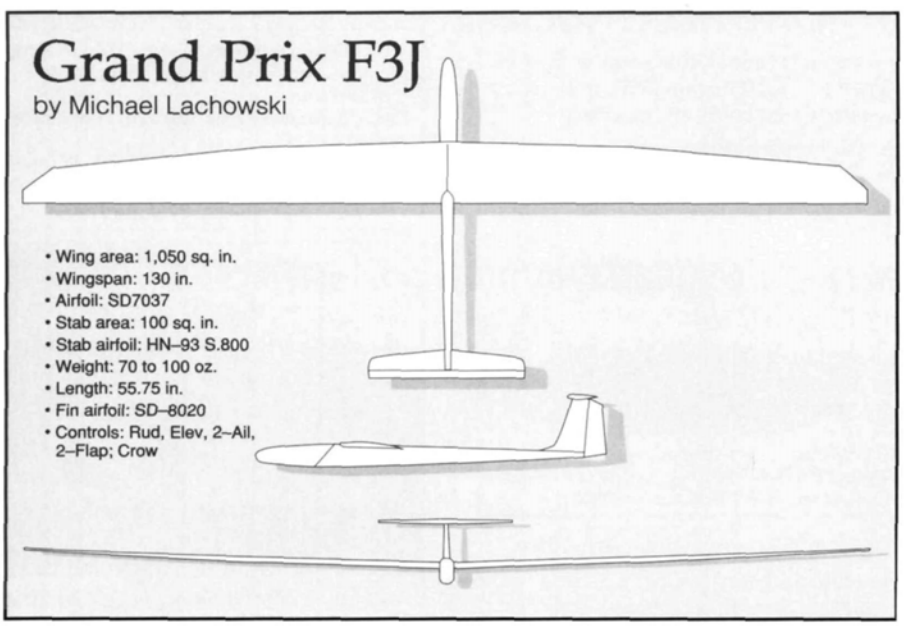
Adding up the scores, Team Wurts (Joe Wurts) was the winner with 14,935 out of 15,000, followed by Team East (Mike Lachowski) at 13,709. Third was Team Jennings (Gordon Jennings) at 13,403 and, in fourth, F3J Bavaria 1 (Stefan Eder) at 13,367, flying a WACO Merlin.

The first WACO Grand Prix F3J contest was a great success. WACO and Slegers International* helped to add an international flavor to the contest by providing the airplanes and radios for Stefan Eder and Klaus Bungeroth. Eighteen rounds and three days with different weather conditions each day made it interesting and challenging for all the pilots. Now we need to beat Joe more than just one day.

F3J TIPS

Strong winds require strong line and airplanes. In over 15mph winds, you need to take advantage of F3J's permitting the use of two different models that can be switched at any time. These conditions are perfect for an F3B model. You need both the strength and the ability to penetrate the wind. Most teams brought 150-pound test towline. With a strong model and strong wind, you need 200-pound test line. Strong winds and sink hurt a few pilots when they were unable to get within 75 meters of the landing area, resulting in a zero.

Most pilots at the WACO Grand Prix used 150-pound test line. Some pilots tried lighter line, including 80- and 100-pound test line. The lighter line is fine on a calm day or when flying a 2-meter model. Wind and large models require strong line. Good-quality monofilament line is important, too. Pilots who first used the 150-pound test Graupner* line and then switched to the Jinkai* line were amazed at the difference. The Jinkai is thinner



Stefan Eder and Soartech editor Herk Stokley discuss R/C soaring. That's a can of bug spray in the middle—definitely needed for survival at times.

Equally interesting are the landing areas at the end of a round with good lift. Imagine eight models all setting up for approaches at the same time! There was only one mid-air collision on landing approach during the whole contest.

and provides more stretch. It is also more flexible and easier to tie.

Storing the line is another problem. The only hand winch available is the Graupner winch. A different approach used by some teams was to use an electric cord reel similar to the reel some folks use to store high-starts. The Graupner hand winch can wind up the line much more quickly. This allows lines to be cleared in crosswind conditions so you don't impede re-launches for other teams in the flight group.

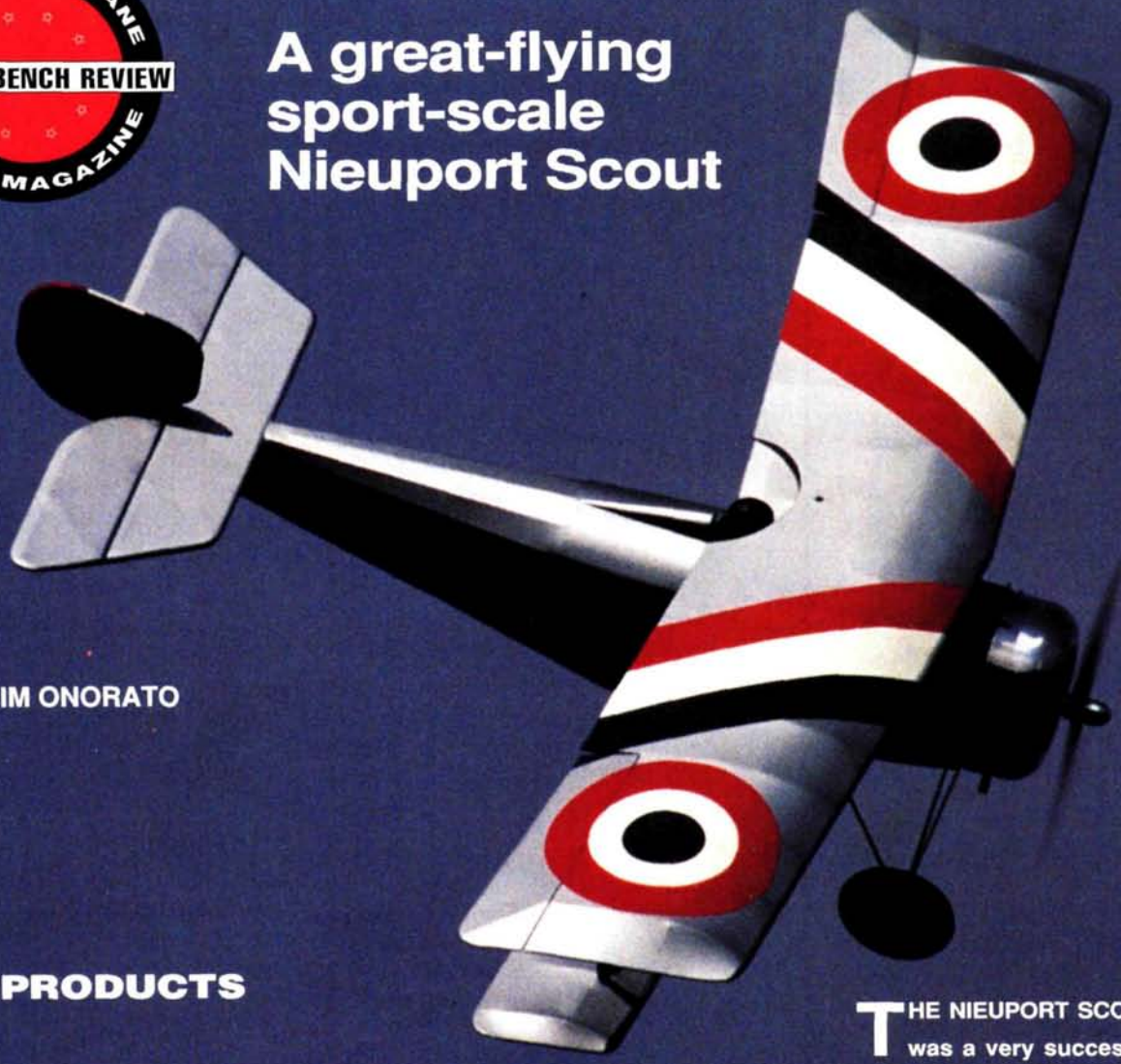
Someone needs to make a really good hand winch. The Graupner one works fine, but it has a few drawbacks. The first is the spool; it is just large enough to hold the 150-pound test line. You would need a larger spool to store 200-pound test line. Don't thread the line through the wire loop provided. The line winds up more easily and with fewer problems with no guide at all. The second modification needed is the handle. It is ideal for winding in the line, but it is hard to hold when you are towing. One nice modification is to bolt a horizontal piece onto the handle, making it an inverted "T."

For pulley towing, the screw-in stakes for holding dogs (available at most stores that sell pet supplies) are great for anchoring the line in soft ground. They can be screwed in quickly and hold much better than straight stakes. Another tow-man safety issue is protection from line breaks. Attaching the pulley to a few feet of rope keeps the monofilament away from your hands in case the line breaks at the knot that anchors the line. Another good idea is to wear gloves and a long-sleeved shirt. They might be hot, but broken lines can hurt.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

A great-flying sport-scale Nieuport Scout



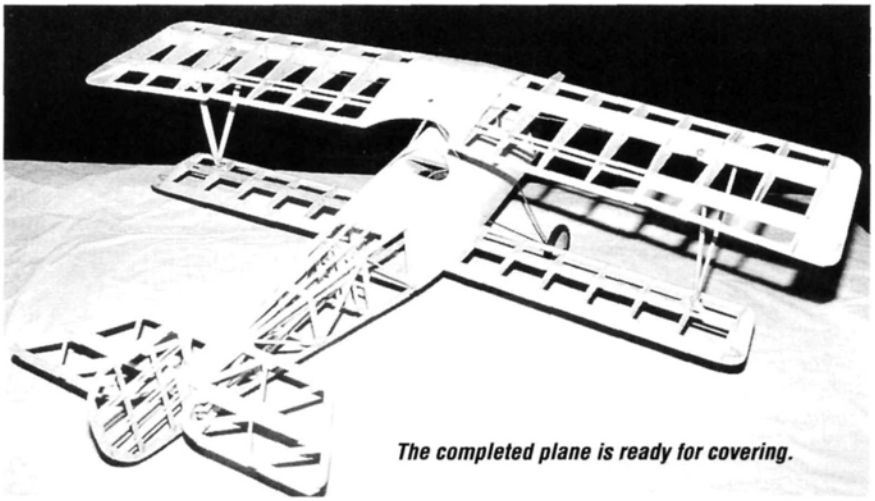
by JIM ONORATO

FLAIR PRODUCTS

Legionaire

THE NIEUPORT SCOUT of WW I was a very successful aircraft and has long been a favorite subject for modelers. The Flair Products Legionaire, distributed by Hobby Supply South*, is a practical, near-scale sport model of the famous French Scout, the Nieuport 17. The main deviations from scale are increases in the chord of the top wing and in the length of the nose. The sesquiplane layout, which is typical of Nieuports, gives the plane a unique appearance. The chord of the bottom wing is just slightly more than half the chord of the top wing—thus, the term "sesquiplane," or one and a half wings. (I learn something every time I build a new kit!)

PHOTOS BY WALTER SIDAS & JIM ONORATO

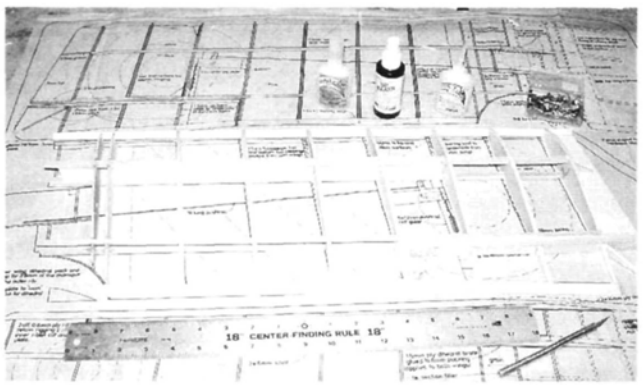


The completed plane is ready for covering.

The Legionaire is one of several WW I-style aircraft specifically designed for the sport flier by Flair Products of Wiltshire, England. Other kits in Flair's Scout Series are the Puppeteer (Sopwith Pup), the Baronette (Fokker DR1 triplane) and the Magnattila (Fokker monoplane). All are roughly .40-size models with wingspans ranging from 49 to 60 inches.

THE KIT

Two things caught my eye when I opened this kit: two sheets of well-drawn plans on some type of tracing paper (possibly vellum) and a really fine-looking aluminum cowl. The plans looked like original India ink drawings, and the cowl was bright and shiny. I soon noticed a big difference between this kit and American-made kits: all the dimensions were in millimeters! But that's no problem; the instruction booklet contains some useful nominal conversions, and I soon got used to working in millimeters.



The wings are built in halves directly over the plans. Here, the right upper wing panel takes shape. The top wing is built with no dihedral.

The Legionaire is constructed mostly of balsa, with a few lite-ply formers. The parts are not numbered, but a parts list is included to help the builder identify the various pieces. The kit includes a fuel tank, an engine-mounting plate, preformed aluminum cabane struts, landing-gear wire, a significant amount of hardware and that beautiful aluminum cowl. The 11-page instruction booklet contains step-by-step instructions and one sketch, but does not include any photos. Having been produced in England, the plans and instructions contain some wording that seemed a bit strange but, again, I got used to it. For example, the word "packing" is used for shim or spacer.

CONSTRUCTION

I used Pacer Technology's* Zap, Zap-a-Gap and Slo-Zap CAs and Zip Kicker accelerator for most of the construction. Pacer's Z-Ends were very useful for dispensing small amounts of Zap and for keeping the tips of the containers unclogged. I used Pacer's 5-minute Z-Poxy to attach the firewall, the landing-gear blocks, the cabane bearers and other hardwood parts.

• **Wing.** The wings are of a double-spar, shear-web design with no leading-edge sheeting. Construction is pretty conventional, but there are a couple of things worth noting. Before you begin construction, make sure there is enough room for the aileron servo you plan to use. The aileron-servo opening shown in the top wing is not large enough to accommodate a standard-size servo. It is not difficult to make the opening larger if it is done as the wing is being built. If you do this, you will also have to reposition the holes for the aileron pushrods.

There is no dihedral in the top wing, but the halves are swept back. The ailerons and aileron servo are in the top wing; there are no ailerons in the bottom wing. The aileron tips in my kit were made of lite-ply instead of balsa, as indicated in the parts list. Also, I found the balsa provided for the trailing edge, the capstrips and the center sheeting to be rather soft.

Compared with the top wing, the bottom wing can be built much more quickly and easily. The leading edge is preshaped and not symmetrical. Make sure you install it right side up! I placed a 1/16-inch "packing" under the front of the ribs when I glued on the leading edge to keep it centered on the ribs.

The six rigging plates to which the V-struts are attached were cut out of the steel stock provided, and a 4-40 nut was soldered onto each. The rigging plates were then epoxied to the ribs in the appropriate positions, sandwiched between 1/32-inch ply riblets.

• **Tail feathers.** Construction of the tail

SPECIFICATIONS

Model name: Legionaire (Nieuport 17)
Type: semi-scale sport
Manufacturer: Flair Products
Wingspan: 52 in. (top); 44 in. (bottom)
Wing area: 700 sq. in.
Weight: 5 lb., 14 oz.
Wing loading: 19.3 oz. per sq. ft.
Airfoil type: flat bottom
Washout built into wing?: no
Length: 40 in.
Radio: 4-channel
Rec. engine sizes: .25 to .40 2-stroke; .35 to .50 4-stroke
Engine used: O.S. FS-48S Surpass
Prop used: 12x6 antique Master Airscrew
No. of channels req'd: 4 (throttle, aileron, rudder, elevator)
Wing construction: wood
Kit construction: balsa wood and lite-ply
List price: $124.95

Features: mostly balsa construction; preformed aluminum cabane struts; preformed wire landing gear; aluminum cowl; excellent full-size plans; most hardware included; engine-mounting plate and fuel tank included.

Hits
- Excellent flight performance.
- Easy-to-follow plans and instructions.
- Aluminum cowl.
- Good-looking overall appearance.

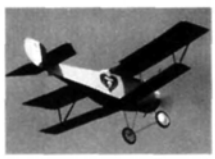
Misses
- No decals included.
- Some materials were different from what instructions indicated.
- Parts not numbered.

FLIGHT PERFORMANCE

I must admit that I was a bit apprehensive about test-flying the Legionaire. I have had some bad experiences with WW I planes that tended to be squirrelly in the air owing to their short nose moments. It seemed to me that the Legionaire would fit into that category, so I took the coward's way out: I let my brother Rich have the honor of taking the first flight while I took pictures! (Unfortunately, this helped perpetuate the myth that Rich flies better than I do.) Fortunately, my apprehension about the Legionaire turned out to be unnecessary!

• Takeoff and landing

Rich is a member of the West Jersey R/C Club, which enjoys the luxury of a paved runway. However, this proved to be a bit of a problem because the Legionaire, with its tail skid, tended to ground-loop on the macadam. (I think the Legionaire will handle much better on grass.) To avoid this, I held the tail as Rich advanced the throttle. When I let go, the Legionaire rolled straight down the runway, raised its tail and lifted off as pretty as a picture. Rich was all smiles!



The landing was smooth and realistic. With the engine at one-quarter throttle for final approach, the Legionaire slowed way down and maintained good directional stability. Rich cut the throttle to idle at the edge of the runway, and a slight flare just before touchdown resulted in a smooth, three-point landing. (Maybe he does fly better than I do!)

• Low-speed performance

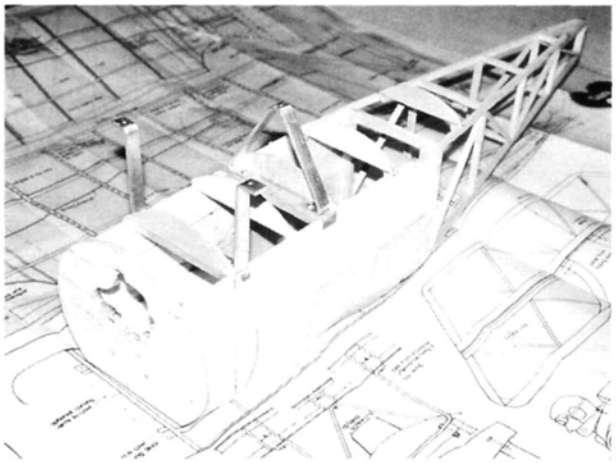
At slow speeds, the Legionaire is stable and predictable and can be flown safely in a scale-like manner. It has a very low stall speed, and its stalls are quite gentle. Its flight is smooth and realistic, with no wiggle or wobble, and the purr of the O.S. FS-48S Surpass adds to the realism. I was pleasantly surprised to see a plane this small fly so realistically.

• High-speed performance

Speed is relative. The Legionaire does not fly fast, but then, neither did the original. The plane flies well at full throttle without exhibiting any bad tendencies.

• Aerobatics

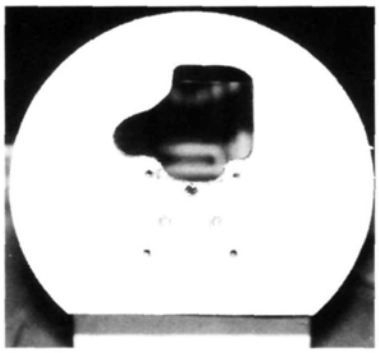
Although not primarily intended to be an aerobatic airplane, the Legionaire is nonetheless capable of performing most of the aerobatics the average sport flier is likely to attempt. It makes great large loops without losing heading and does a respectable axial roll with a little application of down-elevator while in the inverted position. It flies well inverted—again, with a little down-elevator. It is quite responsive to rudder control and does beautiful hammerhead turns and tailspins.



Here's the completed fuselage framing with the cabane struts attached. Notice the side formers.

feathers was straightforward, as they are built up of precut pieces of 3/8-inch balsa and stripwood. The Legionaire does not have a separate fin and rudder; the entire rudder is hinged.

• **Fuselage.** The first step in building the fuselage was to temporarily mount the engine on the firewall. Because the cowl on the Legionaire is so short, the engine is recessed in the firewall so the propeller doesn't stick out too far. First, a clearance hole was cut in the firewall for the carburetor and the needle valve. An 1/8-inch aluminum plate was attached to the backplate of the engine, and this assembly was then attached directly to the firewall.



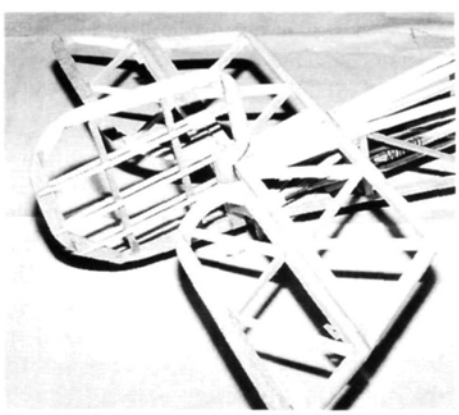
The firewall has to be cut out for carburetor clearance.

Construction of the fuselage was somewhat unusual. First, the two side frameworks aft of the cockpit were built out of 1/4-inch-square stripwood and then joined with six 1/4-inch-square cross-members. When finished, the structure resembled an oil rig. Next, the forward section was built up out of 1/8-inch balsa sheeting. This section contained the hardwood pieces for the cabane strut bearers, landing-gear blocks and the cross-members that take the wing dowels and the wing-bolt nut. The two sections were then glued together and attached to the firewall. At this point, I installed the fuel tank, servo rails and the control linkages. I made the servo bearers removable so I could have access to the tank, and I added a balsa floor in the tank compartment to support the tank.

After installing the underside sheeting and the front and rear aluminum cabane struts, I installed the formers around the forward section and sheeted it with 1/16-inch balsa. (The formers in my kit were liteply not balsa, as indicated in the parts list.) I found it convenient to glue the two side sheets together before attaching them to the fuselage. This kept the sheeting smooth where the two sheets were joined. Installation of the formers and three stringers aft of the cockpit completed the fuselage.

The undercarriage was assembled of pre-bent 1/8-inch piano wire that I bound with 22-gauge copper wire and silver soldered.

I used a 5-inch flexible exhaust pipe to allow me to position the muffler under the engine. That way, I only had to put a small hole in the bottom of the cowl. Four hardwood blocks were glued to the firewall, and the cowl was attached with four self-tapping screws.



The tail feathers are easy to install and, when they've been covered, they're very strong.

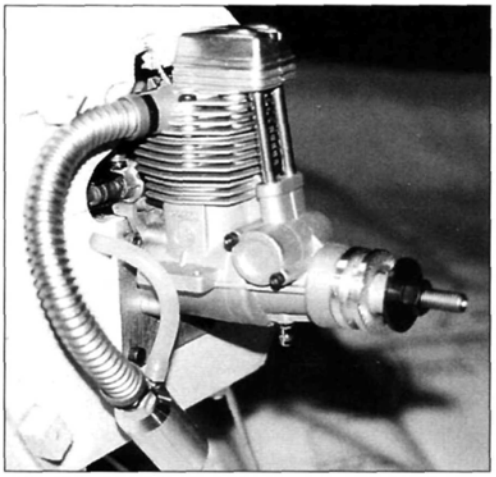
RIGGING

The lower wing was aligned and attached first. This was a bit tricky, as the dowels were epoxied to the top of the wing, rather than in holes in the leading edge. I applied fiberglass and Z-Poxy over the dowels to make sure they wouldn't break loose. The top wing is held in place with three no. 6 nylon bolts; two go up through the forward cabane strut into tapped hardwood blocks, and one goes down through a hardwood

O.S. FS-48S Surpass Engine

O.S.* manufactures Surpass engines in six sizes ranging from the FS-26S to the FS-120S. All are up-to-date, overhead-valve, 4-stroke engines intended for model aircraft, and all are more powerful than earlier engines of the same size.

The makers of the Legionaire recommend an O.S. FS-40 since it has enough power for realistic flight and fits in the cowl. However, I decided to use an FS-48S in my Legionaire and was very pleased with the results. It is almost the same size as the 40, and it weighs only 2 ounces more but delivers almost 25 percent more horsepower (0.8b.hp versus 0.65b.hp). It also fits entirely in the cowl.



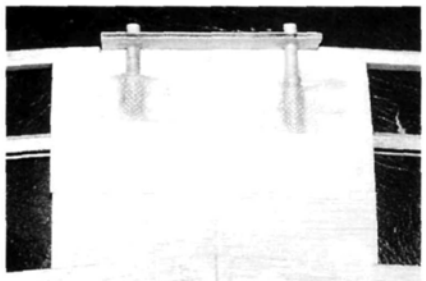
The O.S. FS-48S 4-stroke engine and muffler are mounted on the firewall. Notice the O.S. extension between the two.

The instruction sheet that comes with the engine is very comprehensive and should be of great help to beginners. The engine runs on commercially available glow fuel containing 5 to 15 percent nitromethane and at least 18 percent lubricant (either castor oil or synthetic oil). Only a very short, simple break-in procedure is required, and it can be carried out with the engine installed in the airplane. It has a practical rpm range of 2,200 to 12,000 and can handle propellers ranging from 10x8 to 12.5x6. The FS-48S comes with a muffler.

When I installed the engine in my Legionaire, I used an O.S. 5-inch flexible exhaust pipe to position the muffler under the engine and keep it inside the cowl. Running on 2-stroke, 10-percent-nitro fuel and swinging a 12x6 antique Master Airscrew* propeller at 8,000rpm, the engine produced a very mellow sound that registered only 88dB at 9 feet. The O.S. FS-48S Surpass was an excellent choice to power the Legionaire.

block in the wing into a tapped hole in the rear cabane strut. I Zapped the sheeting on the underside of the top wing where the struts are attached so as to harden the balsa in that area. A small screwdriver access hole was put in the top surface of the wing for the rear screw.

The V-struts are made of hardwood and are joined with a 1/16-inch plywood joiner. I reinforced the tips and the joint with fiberglass cloth, which I Zapped into place.



The bottom wing dowels have been epoxied to the top of the bottom wing instead of being installed in holes in the leading edge. Attention to detail is required here.

FINISHING

I finished the Legionaire with Coverite's* 21st Century fabric and spray paint. The model was covered with their new silver fabric and then decorated with roundels and stripes made of dark-blue, white and light-red fabric. Coverite's new sealing iron made the finishing job easier than ever. The decal on the fuselage was made by my good friend Fred Coleman. Following Coverite's recommendation, I sprayed the entire model with Black Baron flat clear. (Evidently, the silver fabric is prone to becoming scuffed unless it's protected with clear spray.) I added a Williams Brothers* pilot (no. 177), a Vickers machine gun (no. 160) and 4 3/8-inch vintage wheels (no. 132) for the finishing touches.

The Legionaire was fun to build and a joy to fly. If you're looking for a kit that's a little different, try this one. The result of your efforts will be a compact, good-looking airplane that will surely draw admiring glances at the flying field.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

THE VERTIGO

(Continued from page 36)

accommodate this pivot, I sandwiched a 3/32 aluminum plate between the motor and gearbox. Attached to this plate, near the bottom, was a 1/8 music-wire rod secured to the aluminum plate with no. 2 machine screws by two 1/8 landing-gear straps. This assembly was supported on the wire by hardwood blocks (left and right side) glued to the foam center section near the trailing edge.

An adapter must be made to attach the 10-32 lead screw to the 1/4-28 thread on the gearbox. Some spinner adapters may work or be modified to work. (They usually come 1/4-28 to 8-32 but can be re-tapped.) I made mine rather quickly on a small tabletop lathe at work. You may ask, why not just use a 1/4-28 lead screw? Well, I'll tell ya. The nacelle must rotate from vertical to horizontal in no faster than 4 to 5 seconds. Any faster, and the model will lose lift from the fan faster than the forward speed will generate lift from the wing. This will cause a loss in altitude during outbound transition. The number of threads per inch is directly related to the nacelle tilt rate (assuming the motor/gearbox rotates at the same speed for all thread combinations). The more threads per inch, the slower the rotation rate will be. It was found through much experimentation on the Grumman twin-fan VTOL model and some of my own experiments on this model, that a 3.5:1 gear ratio, 32 threads per inch and the available torque from the Astro 020 motor driven by three cells provide just about the right transit time. A 6:1 Graupner* gearbox and a coarser thread might work, but it's doubtful that *any* of the answers involve a 28-thread-per-inch lead screw.

The nacelle bellcrank is made from two 1/16 sheet aluminum plates. Bend the upper portion of the outboard plate as per plan to provide spacing for the 10-32 lead-screw pivot block. Note that the inboard plate is flat, and the outside plate joggles outboard to allow clearance from the nacelle wall. The lead-screw pivot block was made of 3/8 aluminum rod. The ends were turned down to 1/4-inch diameter to fit into the holes in

(Continued on page 96)

HOW TO

FLOAT FLYING is becoming more popular every year. Almost any model can be adapted to fly off water with little loss in performance. Simple, inexpensive floats can be cut from a variety of foam and, best of all, they cost less than $20 a set.

Foam floats are waterproof, unsinkable and, in most cases, lighter than built-up wood. They take less time and are easier to build than their wooden counterparts, and several sets can be cut out of one sheet of foam. I prefer flat-bottom floats over vee-bottom floats because they're easier to build, they get up on step faster, and they work very well when flying off snow or ice. Let's get started.

Make Rugged Foam & Fiberglass Floats

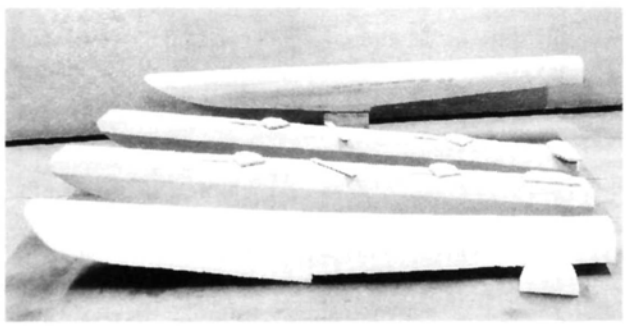
by DAVE WINDOM

Flying of

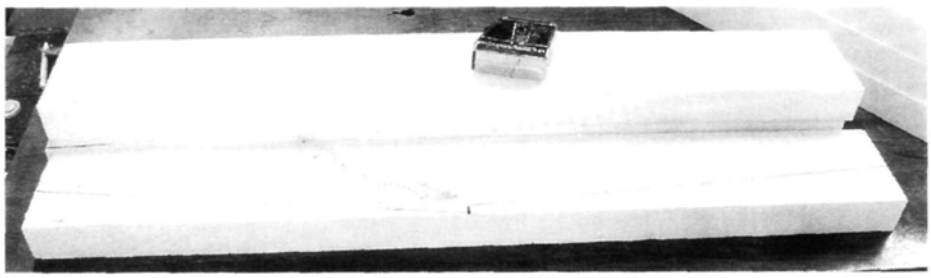
Materials

- 4x4-foot piece of foam
- 10x12-inch piece of 5/32-inch-thick plywood (for aft bulkheads and float-gear mount plates)
- 1—1/2x12-inch piece of 1/16-inch-thick plywood
- 4—36x1/8-inch lengths of music wire
- 2—36x3/16-inch lengths of music wire
- 5 nose-gear bearings
- 5 wheel collars
- 20 no. 4 sheet-metal screws
- 10 feet of 90-pound-test monofilament

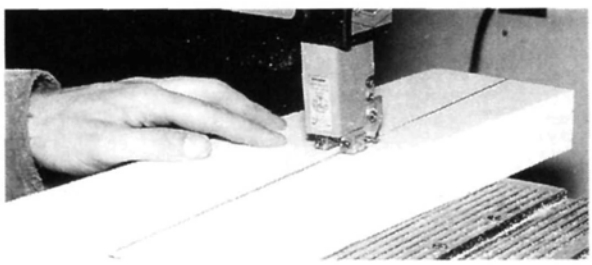
- 4 brass crimps
- 2 nose-gear steering arms
- 2 yards of medium- to heavy-weight fiberglass cloth
- 5-minute finishing epoxy
- Can of spray adhesive

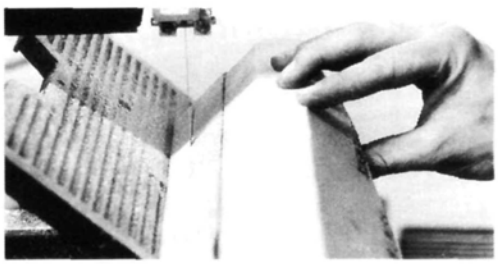


1 Foam comes in several densities, and it's available at hardware stores and insulation companies. White, open-cell foam is the lightest, and it's the traditional foam used in float construction. Denser, heavier foam is available in gray or blue sheets. Made of closed cells, it's more rigid and easier to carve than the white foam.

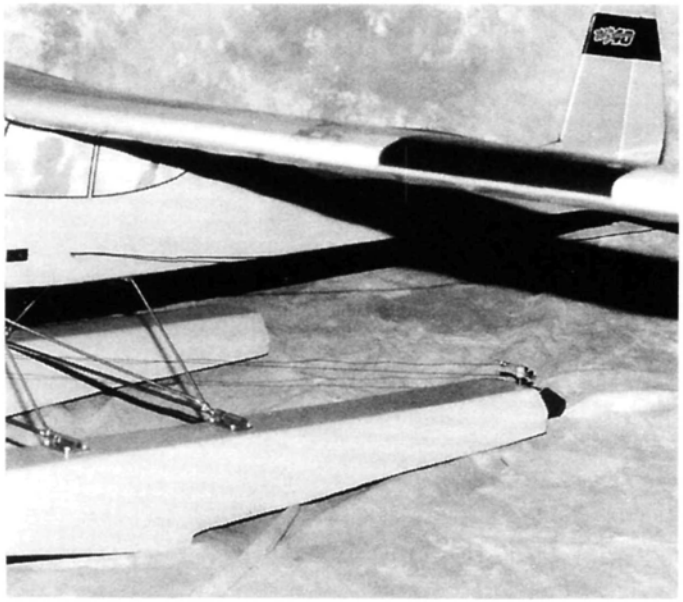


2 I use a simple formula to determine float dimensions. First, measure the plane from the spinner's backplate to the elevator's trailing edge. The length of the floats should be 75 to 85 percent of the fuselage length. The depth is 10 percent of the float length, and the width is 12 percent of the float length. The step at the center of the float is placed directly below the aircraft's CG. (I use a 1/2-inch-deep step.) The slope forward of the step should be about 5 to 7 degrees and gently rounded at the tip. The slope aft of the step should be 5 degrees. The float's tips should extend at least 2 inches in front of the propeller. Make sure you leave enough depth at the aft bulkhead to attach the water rudder. Mark these dimensions on the foam blanks with a fine-tip marker.

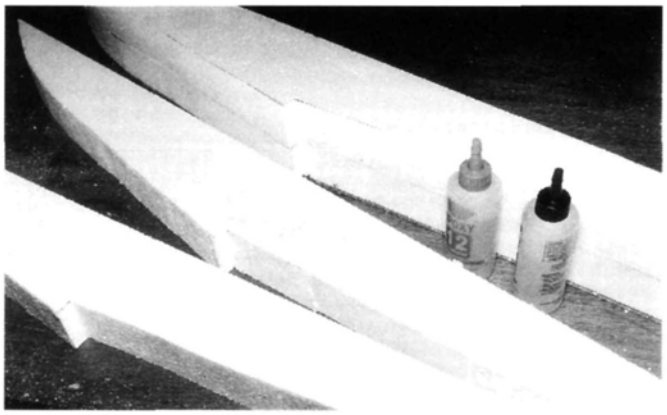




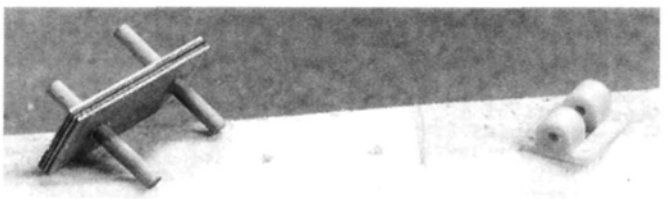
3 Using a band saw, cut the step, the rear slope aft to the step and the front slope from the step forward. Always wear a dust mask when you cut foam. If you use a one-piece, non-laminated float, tilt the band-saw bed, and cut a bevel on each side of the float top to improve its appearance.



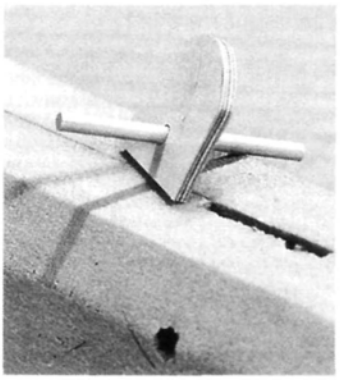
water made easy

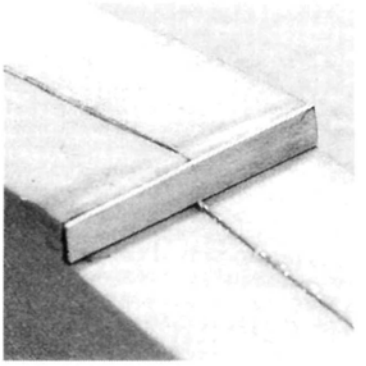


4 If you laminate foam to make the finished float, glue the layers together with epoxy or white glue. Use a small amount of adhesive, and only apply it to the center of the mating surfaces. This way, you won't run into any glue when you cut out the floats. When the glue dries, cut the top bevels.



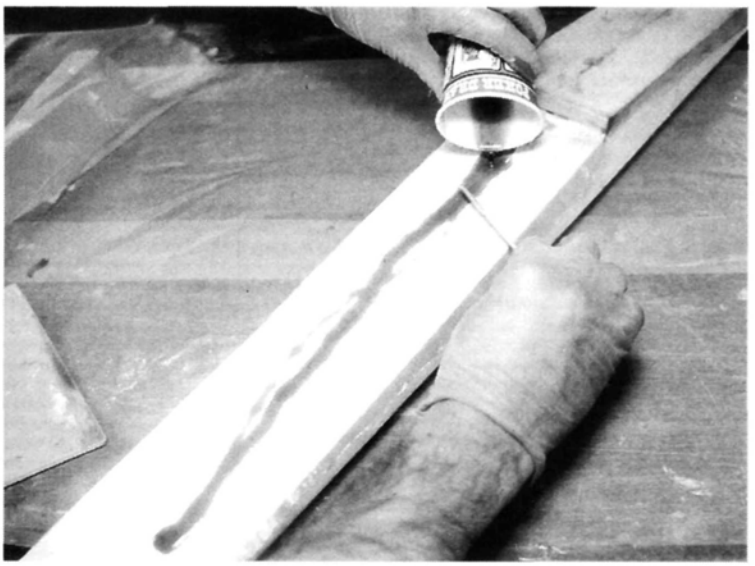
5 Next, cut recesses in the tops of the floats to fit the 5/32-inch-ply, gear-attachment plates. To mount the floats on the landing gear, I screw nylon nose-gear bearing brackets to the attachment plates. These plates should be flush with the top of the float and secured with lengths of 1/4-inch dowels that are anchored to the foam. If hardware isn't used, the plywood mount plate can be mounted vertical on the float and secured to the axles with wheel collars. This method is especially easy to do on a laminated float before the layers are joined.

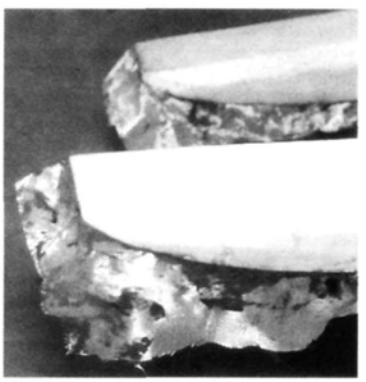




6 Epoxy a 1/16-inch-ply reinforcement plate to the rear face of the step. This plate strengthens the step and helps to keep the edges sharp when the float is sanded. Sharp edges at the step ensure easy takeoffs, especially from smooth water. To provide a solid mounting point for the water rudder, epoxy a 5/32-inch-ply plate to the rear of the float. Fill any dents with light filling compound, and sand the floats smooth.

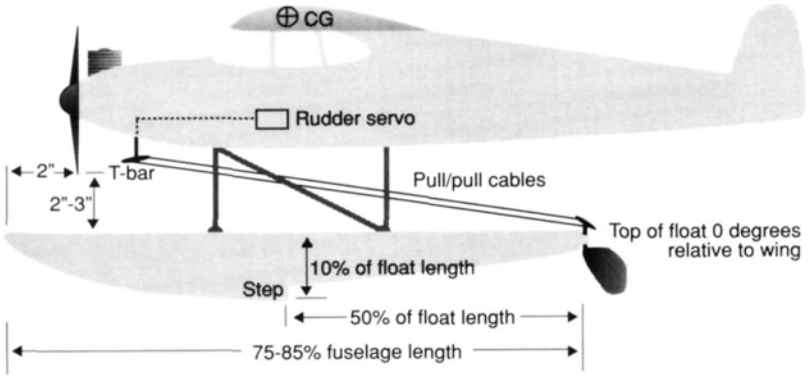
7 Using 3M 77 spray adhesive, spray the bottom of the float and about halfway up both sides. Gently roll medium-weight glass cloth over the bottom of the float and up its sides. There's no need to cover the ply step plate with glass; it will be waterproofed with epoxy. I use a two-part finishing resin that's thinned about 25 percent with alcohol. Any good-quality laminating or finishing epoxy with a long pot life (the amount of time you have before the epoxy dries) will work.

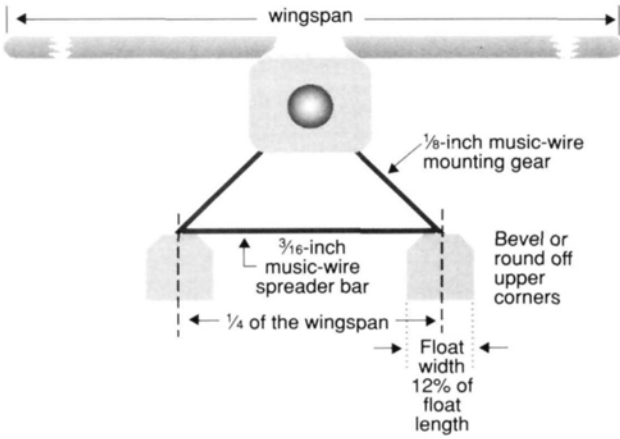




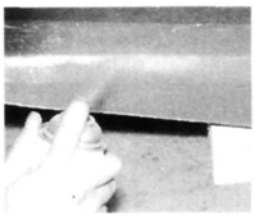
8 Pour the resin along the center line of the float, and spread it with a squeegee or a playing card. Wet the entire bottom of the floats and the side overlaps. Set the floats aside to cure (overnight is usually sufficient). When they're dry, trim and sand the areas to be covered with the overlapping top cloth. Following the same procedure that you used for covering the bottom, cover the top of the float and the sides with one piece of cloth.

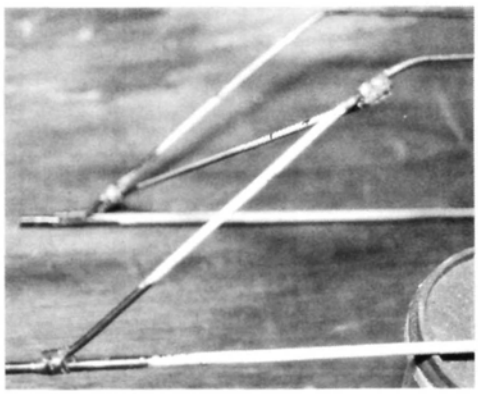
Float Schematic





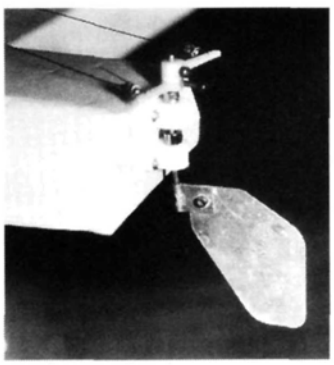
9 All that remains is sanding, priming and painting. To fill in the weave of the cloth, use a spray primer that can be sanded; it's much lighter than epoxy. Paint the floats with a fuelproof paint of your choice, and start making the mounting gear.





10 Use ⅛-inch music wire to make the main gear legs and the diagonal braces and 3/16-inch music wire for the spreader bars. Cut the spreader bars so that the distance between the center lines of the floats equals one-quarter of the wingspan's length. The main braces and the diagonal braces should be high enough for the bottom propeller tip to be at least 2 to 3 inches above the float tops.

11 Mount the floats on the plane, and make sure that the steps are below the aircraft's CG. The float tips should extend at least 2 inches in front of the propeller. The tops of the floats should be at 0 degrees incidence relative to the wing. If your plane has trouble rotating for takeoff, shim the floats to get a slightly negative incidence.



12 Assemble and attach the water-rudder hardware and control linkage. To activate the water rudder, I use a nose-wheel bearing bracket to mount a T-bar in the model's nose. The T-bar is connected to the rudder servo, and it has pull/pull cables leading from it to the water rudder.

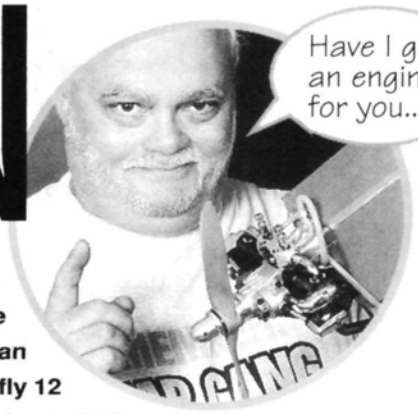
I'm sure you'll find that these floats perform very well and are just about bulletproof. Should you happen to break one, a few minutes with some epoxy will have you flying again in no time. Best of all, you won't have spent a fortune. ■

PRODUCT PREVIEW

SAITO 100 TWIN

As a scale modeler sees it

by FRANK TIANO



I SWEAR I'M not trying to rub it in, but living in sunny south Florida sure does have its advantages. As you can well imagine, having the opportunity to fly 12 months of the year is certainly one of them. And for all you "Sporty Scale" fans who think that all I do is hang out in my workshop and build, talk and draw scale model airplanes, it just ain't so! In fact, FTE* employee Pat McCurry and I set two days a week aside to do nothing but fly sport airplanes on an expanded lunch hour. If you're wondering where I'm going with this, just give me a few more sentences!

SPECIFICATIONS

SAITO 100

Displacement 1ci
Bore . . . . . .23.4mm x 2
Stroke . . . . . .19mm x 2
Horsepower 1.6
Rpm range . . . .2,500 to 10,000
Weight Approx . . . .820 grams (29 oz.)
Rec. fuel 20% synthetic oil; 5 to 15% nitro
Suitable props . . .12x8, 12x10, 13x6, 13x8
Special feature: Diaphragm pump

Pat McCurry, FTE's warehouse manager and an excellent flier, puts the Saito 100 Twin-powered Ugly Stick through its paces.

Often, I'll use a sport ship to test a new radio or check an engine's performance. Because of inclement weather in the northern part of the country this past winter, senior editor Chris Chianelli asked me whether I could run one of Saito's new 100 Twin engines through a few preliminary tests while Mike Billinton was preparing his full-blown review for a later issue. The tests included the general performance of the little engine, its user-friendliness, rpm figures—you know, the usual stuff. As a bonus, Horizon Hobby Distributors* (the engine's U.S. distributor) was shipping the very first Saito 100 in the country down to me, already attached to one of their Long Tai Shin ARF Ugly Sticks—my least-favorite airplane design ever, but that was soon to change. Read on.

The very bottom line is that the Ugly Stick—a typical .60-size model with a 61-inch span—performed really well with the new 4-stroke 100 and proved to be a stable, yet aerobatic, design with good wind penetration. It takes off and lands easily and will do just about any maneuver except sustained knife-edge flight and snap rolls. All rolling and looping maneuvers are done well.

TWO NEEDLES

The Saito 100 needed very little tweaking or fiddling to make it run perfectly. The new-style, twin-barrel, single-body carb has two needles that are set concurrently to get the proper fuel mixture to each cylinder. I opened both needles exactly three turns, put two Ni-starters on the rear-facing plugs and fired the thing up. I slowly peaked each needle and could definitely hear the cylinders come up to full power. When I was confident that I had the right needle settings, I simply backed each one out a couple of clicks and flew the airplane.

The 7½-pound Stick went almost perfectly vertical until it was nearly out of sight! That's with an APC* 14x6 prop turning at exactly 9,900rpm! In all attitudes, the 100 performed flawlessly, never offering even a hiccup. Transition from idle to full power never produced anything but a clean surge. All in all, it's an excellent performer—one that I must have permanently in my engine inventory!

Before the end of the second flight, I found myself making a mental note of which scale projects might accommodate one, or two, of these fabulous Saito 100s.

NO BAD VIBES!

Some of the more common information that might benefit sport fliers includes that this engine has none of the vibration problems sometimes associated with other twin 4-strokes of similar size. It's far better than the Saito .90 twin this engine replaces—more powerful and much smoother. The quality and quantity of its sound can only be considered great and minimal, respectively. Since the plugs face rearward, it's easy to start, and because the rods share the same crankpin, both cylinders are straight across from each other (as viewed from the top; no offset). This makes installation easy in lots of subjects.

Try these kits with the Saito 100 twin

—or with any sport design that weighs less than 16 pounds with 700 square inches or more of wing area:

Ace*—Weeks Special
Platt*—Jungmeister
Byron*—Sukhoi
Royal*—Cessna 172; PT-17
EZ*—Chipmunk
Sig*—Cub; Skybolt
Goldberg*—Xtra; Ultimate
Sterling*—PT-17
Great Planes*—Cap 21
Top Flite*—Corsair; T-6
Pica*—Cessna 182; Waco

The engine measures exactly 6¾ inches from rocker cover to rocker cover, so anything with a 7-inch cowl will easily accommodate this little powerhouse. From the back of the included engine mount to the drive washer measures just 4 inches. And if your drool factor is up around 9½ by now, the distance from the center line to the top of the needle valves is exactly 2¾ inches, give or take ⅛ inch for adjustments. Though we ran the 14x6 exclusively, we also tested larger props and found that the 14x7, 15x6 and 16x6 all work very well. If you need speed, stay with the props that produce 9,500rpm or so. Cub-style models will perform best on a 15- or 16-inch low-pitch prop.

The ARF Ugly Stick has a suggested retail price of $189.95, and the Saito 100 Twin is listed at $739.95. Since Horizon sells directly to dealers, you can cut your own special deal with your local hobby shop, and they can order each of these for you.

SUMMING UP

Nothing else to say on this one. This may be the very nicest all-around small engine I've had the pleasure to handle in several years. And that's the absolute truth. I'm sure that there's a lot of great stuff out there, but I don't get into 4-strokes that much because I usually fly with engines of larger displacement. Saito has a real winner here, and Horizon should be very proud to have it in their inventory.

I like this engine so much that I ordered a second one, and they'll both go in my recently designed, 90-inch-span Cessna Bobcat. Do you remember Sky King?

I'll keep you posted. Your six is clear.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

SPORTY SCALE

FRANK TIANO

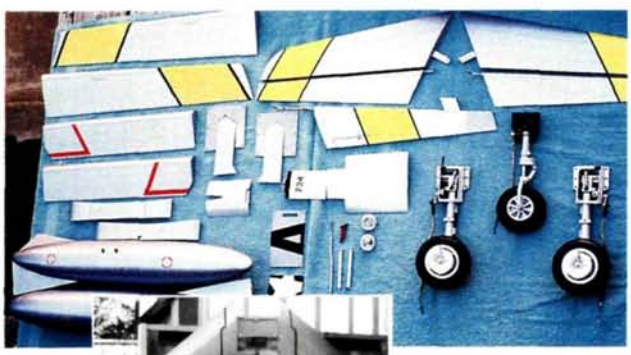
PROJECTS AND PERFECT FILLET JOINTS

A FEW ISSUES ago, I mentioned that we'd be happy to print pictures and information relative to any scale project our readers may have been working on or have completed. Holy smokes! Your response was overwhelming, to say the least; and, best of all, most of what I received was not only different, but it also had some sort of story attached.

When is one picture worth a thousand "holy cows"? This time! Bob Campbell's monstrous 747 is constructed of foam and 1/8-inch sheet balsa. Covering is done entirely with MonoKote! Bob also owns and operates R/C Kits Mfg.

ENLARGED SABRE

A good example is the note I got from Dick Rotkowsky out of Austin, TX. Dick has been flying and winning awards for years now with one of several BVM* Sabre Jets. He has won everything from Best of Show at Toledo to Best Jet in Texas. And I'll have you know that this guy flies as well as he builds. Anyway, Dick and I had a conversation a couple of years ago about how we thought the F-86 needed to be just a little bit bigger—maybe approaching the size of the Violett* or Jet Model Products* T-33. Well, get a load of what Dick has done over the past two years. This is one case where the pictures certainly do the plane justice! Now, we know that Mike Kulczyk's big F-84 flies great at 24 pounds, so why not believe that a big Sabre would fly as well at 22 pounds? Dick's almost square Sabre measures 72 inches in span and is 73 inches long. It's exactly 1/6.2 scale and has a wing loading of under 45 ounces per square foot. Naturally, a Violett .91R engine and Viojett fan power the beast. Performance is right on—just what you might expect from a big, subsonic jet. As for availability, I really don't know yet. But, I bet a call to BVM will produce some results.



Dick Rotkowsky has done an outstanding job scaling up Bob Violett's acclaimed F-86. And as you can see, he's quite the painter as well. The speed brakes will really slow the big jet down prior to landing; each is operated by its own servo. The wing is shown with the inner landing-gear doors installed and all markings applied. Rivets come later—all 24,000 of them! With all the completed, painted parts laid out on a blanket, it's sorta like looking at the world's best ARF jet. Don't we wish! New, enlarged BVM brakes are installed on the main gear, and all control surfaces have been riveted.

AIR FORCE ONE

Another impressive aircraft is the one shown by everyone's favorite retired school teacher, Bob Campbell. Now, before you think that Bob is certifiable, let me remind you that no one individual in the entire free world has had the degree of success with oversize models that the man in the picture has had. According to Bob, this rendition of Air Force One "just had to be done." Well, at 1/24 scale, the monster spans 8 feet and measures more than 9½ feet long! Possibly, the most unbelievable statistic is that Bob designed and constructed the thing in 600 hours over a

United States Scale team member Kim Foster shows us what kind of effort it takes to do well in international competition. The Pup spans 80 inches and is powered by a Laser 200V engine. Weight at this point is 12.2 pounds. Outdated rules allow only 15.4 pounds for FAI World events! Good luck, Kim!

period of just three months! At 42 pounds, the four O.S.* 91s and Dynamax* fans will have absolutely no problem handling this project. Look for it soon at a mall near you.

PERFECT PUP

"From one extreme to the other" is probably the correct caption for the entire next paragraph. Kim Foster, the one from Mansfield, OH, not the eyeglass guy, has been competing in Top Gun and other noteworthy contests for several years now. He almost always campaigns a lovely—no, magnificent—WW I biplane of some sort. This year is no exception, and Kim is just finishing his World Champs entry—a 1/4-scale Sopwith Pup. This Pup is something to marvel at, something to take pictures of, something to drool over, something to be in awe of, something to maybe steal when Kim isn't looking—you know, kind of fabulous. It's no secret that I have about as much interest in WW I aircraft as I do in watching a good game of Parcheesi, but this kind of craftsmanship can certainly change one's mind.

THRIFTY TX TRAY

Some brand-new stuff has made its way to our marketplace, and I'd like to inform you about it. First is possibly the

MAKING PERFECT WING FILLET JOINTS

Several enthusiasts have asked me to describe the pro- cedure used to get a perfect joint between an airplane's wing fillet (pronounced fil-let, not filay) and the top wing skin. Be aware that many aircraft didn't have a smooth-flowing junction at all.

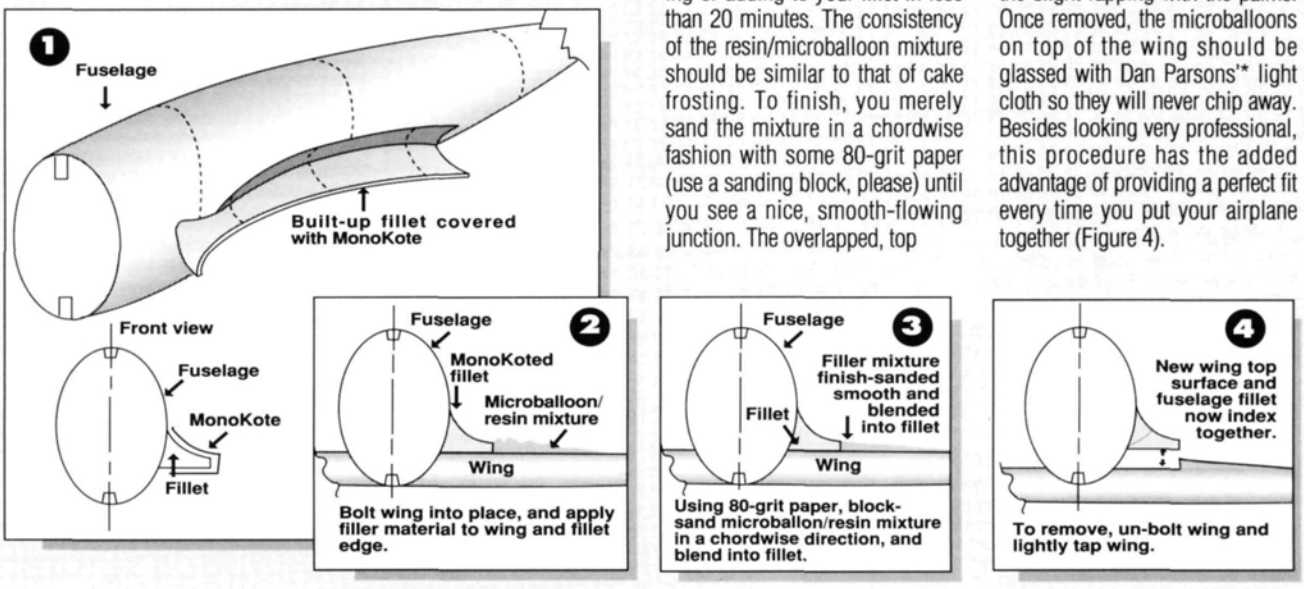
In many cases, the wing fillet material simply lay on top of the wing skin. When you consider that the aluminum used for a fillet was about 0.020 inch thick, this wasn't such a crude way of doing things. In any event, some subjects had a higher degree of craftsmanship, and this is what we wish to duplicate.

FLUSH FILLETS

The procedure is very similar to that explained in a previous "Sporty Scale" column that showed how to get perfect cowl joints using the MonoKote*, or wax paper, and resin/phenolic microballoon mixture. To be successful, the wing and the fuselage must be fiberglassed. This won't work on a film-covered structure. Once you're perfectly satisfied with the shape of your wing fillet, you must carefully MonoKote the edges so that the excess film can be wrapped around and tacked to both the top and bottom surfaces of the fillet (see Figure 1). Make certain that the edge is fastened securely with no "wrinkoes." A "wrinkoe," by the way, is a wrinkle that you catch too late and say "Oh . . . !"

Next, bolt the wing and fuse together and "shmear" a liberal coating of your favorite resin/phenolic microballoon mixture on the top surface of the wing, starting about 4 inches away from the fillet's edge (see Figure 2). An expired credit card or a bodyshop squeegee works well as a trowel to help get the resin smoothly in the right place. I use K&B* polyester resin or Sig's polyester; both work well. I don't use my own Z-poxy finishing resin because it's an epoxy product and takes too long to set up. The polyester can be over-kicked, and you can be sanding or adding to your fillet in less than 20 minutes. The consistency of the resin/microballoon mixture should be similar to that of cake frosting. To finish, you merely sand the mixture in a chordwise fashion with some 80-grit paper (use a sanding block, please) until you see a nice, smooth-flowing junction. The overlapped, top edge of MonoKote will be sanded away, leaving you with a fine line of MonoKote at the edge, which shows you where your break or joint will be when you separate the wing from the fuselage. Figure 3 should be all but perfectly explainable to anyone other than a person wearing sunglasses in a darkroom with no windows—at night.

The last step requires a little trust and a gentle touch. Remove the wing bolts and gently tap the wing with your palms to remove it from the fuselage. Trust me! The MonoKote will *not* allow the fillet to stick to the resin because it has acted as a parting agent. But, you must release the original close contact of the two surfaces, thus, the slight rapping with the palms. Once removed, the microballoons on top of the wing should be glassed with Dan Parsons'* light cloth so they will never chip away. Besides looking very professional, this procedure has the added advantage of providing a perfect fit every time you put your airplane together (Figure 4).

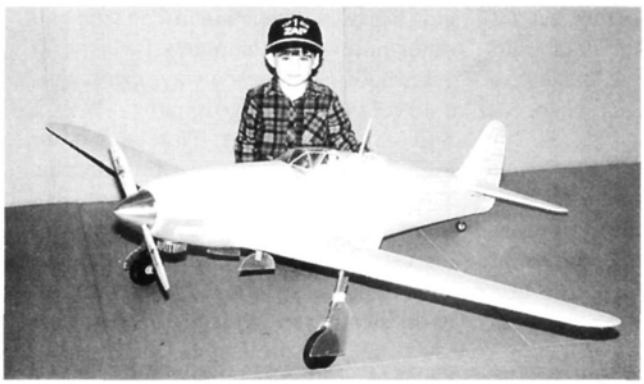


niftiest little transmitter tray that I've seen in a very long time. What makes it so special? Simple. It's really light and uses a neck strap instead of those bent-metal contraptions that make you feel as if you're in an iron lung or something. It's fully adjustable in minutes, using simple hand tools, not Sears' best selection, and it's dirt-cheap. How cheap? How does a twenty-dollar bill sound? Petal Mfg.* makes and sells them. Send an SASE for their info sheet, which explains two styles and lists the five colors. Now you can reach all those awkward switches without your radio doing half a Cuban-8.

Petal Mfg. has a compact, inexpensive transmitter tray with optional side pads that can fit everyone's needs. There are two designs to fit radios with or without a handle. An adjustable cloth strap avoids the cumbersome metal strap found on most other trays.

MAD ABOUT MADDEN

Our next "newsbreaker" is a person, not a thing. Gary Madden is the exclusive kit cutter for all those Don Smith plans that you've been salivating over for the past few years. He offers full kits and partial kits. An SASE gets his price list. Charlie Chambers and I recently bought a couple of Tony kits from Madden Model Products* and were quite pleased with the wood as well as the cutting. We found two parts out of the entire lot that seemed a bit off, and a call to Gary was all it took to get the correct parts in a few days. By the way, for those who are interested, Don Smith's KI-61 Tony is the very same Tony that I designed and have been so successful with for the past five years. Don cleaned up my chicken scratchings and offers a remarkable set of plans as well as scale drawings that show all the details and panel lines, full size! Anyway, Gary's kits retail for $270 to $385 and, yes, he does have Smith's new 105-inch A-26 and 86-inch Hellcats.



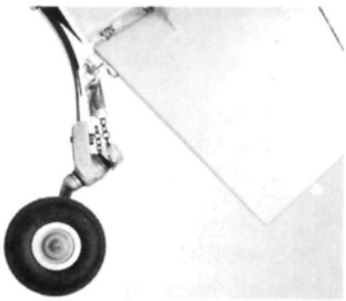
Young Jeffrey Madden last graced our pages in a triplane Halloween costume designed by his dad. Here's Jeffrey again—this time, with a Madden Model Products' KI-61 Tony framed up. His father, Gary, cuts kits for all of Don Smith's designs.

CIRRUS TREASURES

Any of you guys who are even half serious about building scale models that will last more than a few flights must absolutely send one green dollar to Cirrus Ventures*—a small company that handles nothing but first-class, unique, hard-to-find scale accessories manufactured in Australia. Bill Raub has been doing this for ages, and people like me and Nick Ziroli have been buying Bill's special aluminum pushrods, heavy-duty bellcranks and superb cable systems for years. No kidding! When my buddy Skinnard Bechtold needed a tail wheel for his Top Gun Citabria, Cirrus had just the ticket. Not only did the tail-wheel unit prove to be exactly the correct size, but it also matched the original three-view drawing from the aircraft manufacturer. I use nothing else but their bellcranks in anything that has a wingspan of more than 80 inches. A few words of caution: don't lend out the little catalogue; you'll probably never get it back.

HIT THE BULL'S-EYE

There's a guy in Minnesota by the name of Jim Hobelsberger who has a clever product that we all should probably have. The product is called "Bull's-Eyes*," and it comes six to a package for only $3 postpaid. Now Bull's-Eyes will make any hinging job a really easy task as long as you do two very important things: (1) buy the Bull's-Eyes and (2) plan on using Robart's* Hinge Points or Klett Flex Point hinges. Here's the deal: after drilling the hinge holes in the left wing panel to receive the aileron, simply place the Bull's-Eyes in each hole, and press the aileron into position. The Bull's-Eyes will automatically put a little pinprick at the exact center where you must drill the corresponding hole in the aileron so that everything matches up nicely, and you don't say any bad words as you do when the holes don't line up! If I get just one letter saying that the previous explanation is unclear, I promise to print a diagram showing how this neat product works, along with, of course, the name of the escapee who doesn't get it.



How realistic can you get?—not much more than this. Cirrus Ventures' tail-wheel unit is the Cadillac of the bunch with cast parts and a realistic tire and hub. Cirrus Ventures carries the entire line of Scale Aviation accessories from Australia.

It's a shame, but I'm just about out of my allocated space this month. Next time, we'll discuss some tools that you oughta be saving up for, address the problems associated with putting the wrong prop on an engine and give some other workshop hints. Until then, remember that those great Newman Optics glare-proof, wrap-around sunglasses are just what you need to discreetly check out that occasional 3 or 9 o'clock friendly!

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

THE VERTIGO

(Continued from page 79)

the bellcrank. The middle (across the rod) was tapped for the 10-32 rod. The ends of the rod were tapped for 4-40 retaining screws. The fit between the aluminum-rod pivot block and the bellcrank must be slop-free, or the nacelle will "chuck" back and forth, causing control problems in the hover mode. The bellcrank assembly was secured to the hardwood nacelle pivot block with four no. 4-40 flat-head screws. Note that the bellcrank is mounted 45 degrees tipped forward with the nacelle horizontal.

Microswitches (an electrical schematic is shown in Figure 8, which comes with the plans) were mounted to plywood plates that, in turn, were glued to the wing center section just under the bellcrank as it reached the extreme up and down positions. A small sheet-metal pad was mounted to the bellcrank to ensure contact with the microswitch. The plans show the recommended wire route scheme. You can use it as a guide, not as an absolute, as you may find you want to do things a bit differently if you use different hardware. No aerodynamic fairing was attempted over this nacelle-tilt mechanism. Although

(Continued on page 104)

HOW TO

Ducted-Cowl Design

PART 1

Make a low-drag, engine-cooling cowl

by ANDY LENNON

OUR MODEL AIRPLANE engines, by themselves, are beautiful, powerful examples of precision machining and engine technology.

Hung on the front of a model airplane and left uncowled, they are hideous from a drag point of view. Even when partially cowled but with the cylinder sticking out, they make a model look like a full-scale Cessna 172 with a garbage can above the engine just behind the prop—ugly!

A well-designed cowl greatly reduces drag, improves a model's appearance and actually improves engine cooling. Note the similarity to a turbo-prop engine installation in photo 1. Why are there so few cowled engines among the many models, both kit-built and original designs, at our flying fields? This author surmises that there are three major objections:

• Removing a cowl to service the engine is a nuisance to be avoided. In most cases, it is necessary to remove the spinner, the prop, the needle-valve needle and up to half a dozen small, easy-to-lose screws. Replacement reverses this boring sequence.

• Cowls are difficult to make.

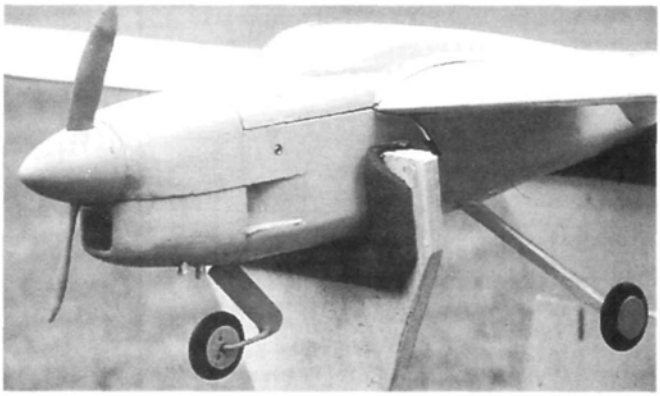
• Fear that a cowled engine will not be adequately cooled.

The design, construction and fastening of the cowls described in these articles respond to and overcome all three objections.

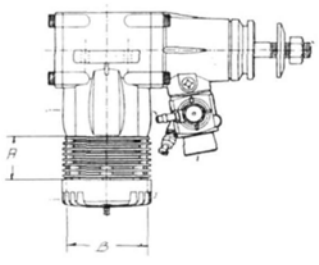
• The removable portion of each cowl described is almost ridiculously easy both to remove and to replace. Taking off the spinner, the prop and the needle-valve needle is unnecessary, and there are no screws to laboriously unscrew (and lose). The engine is easily accessible for servicing.

• Such a cowl is easy to make, as these articles will demonstrate.

• Engine cooling is adequate, as proven by test runs, on hot summer days, at full rpm with the model stationary and consuming full tanks of fuel.



The Swift's cowl; note the jack location.



Tractor engines
Inlet area A x B
Outlet area (A x B) 140%
Pusher engines
Inlet area (A x B) 140%
Outlet area (A x B) 140%

FIGURE 1
Sizing cooling-air inlets and outlets

DUCTED-COWL DESIGN

For minimum drag, the cooling-air entry should be as small as possible, yet large enough for adequate cooling. Bear in mind

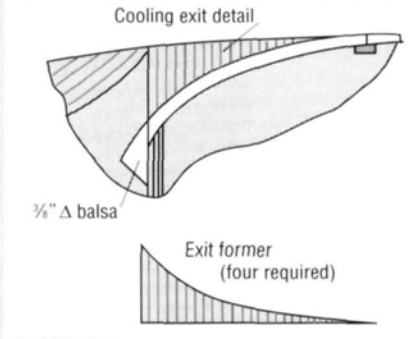


FIGURE 2
Cowl top view—internal muffler

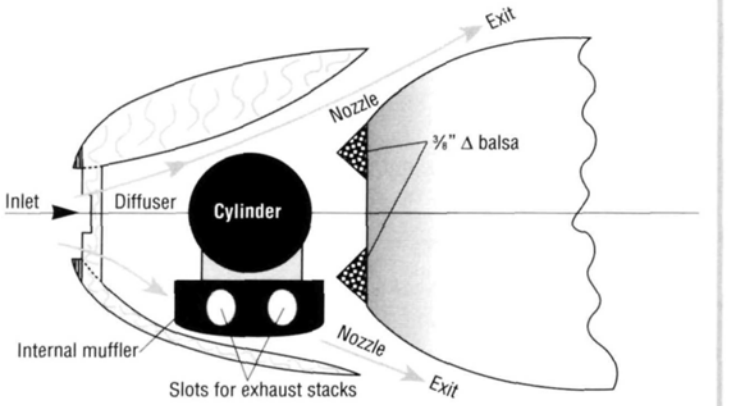
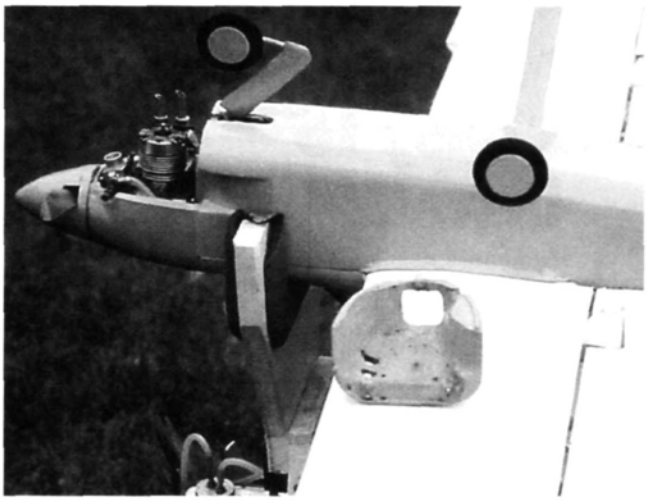


FIGURE 3
Cowl section A-A (see also Figure 6—internal muffler)



Half the cowl is off; note the engine accessibility and the detail of the detachable portion.

that only the air that actually contacts the cylinder and muffler does the cooling. Air passing 1 inch away from the cooling fins does nothing.

A good, low-drag cowl design requires:

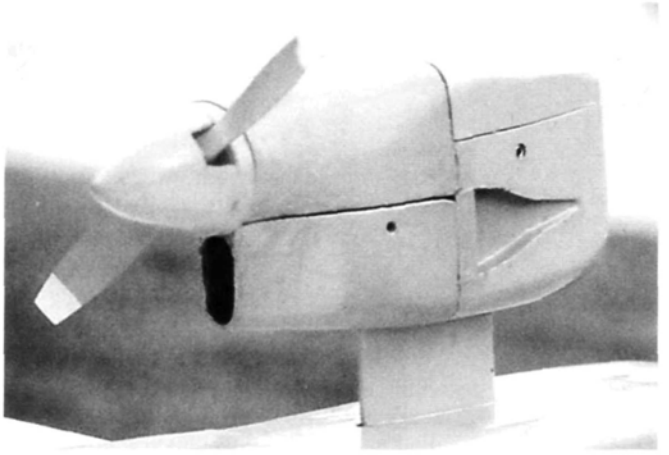
- An inlet.
- An expanding chamber, or "diffuser."
- The item to be cooled: radiator, or cylinder and muffler.
- A contracting part, or "nozzle(s)."
- Outlet(s) into the passing air stream at point(s) of low air pressure.

Prop-driven air enters the diffuser, slows down, cools the cylinder and muffler, expands because of the heat absorbed, speeds up in the nozzles and exits at considerable velocity. British WW II Hurricane fighters' ducted-engine coolant radiators were based on these principles; they contributed thrust, not drag. The hot, expanded air exiting the duct's nozzle provided some jet-like propulsion. This is not to suggest that these cowl designs will contribute thrust, but there will certainly be substantial drag reduction.

INLET AND OUTLET SIZING–TRACTOR ENGINES

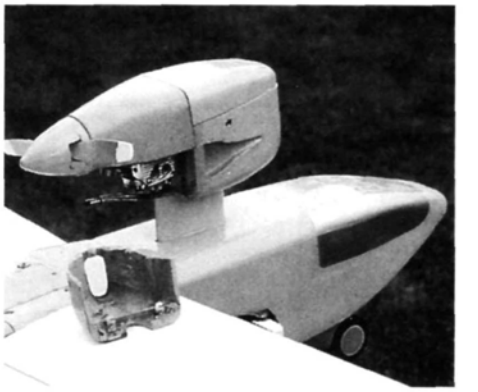
Figure 1 shows the side view of a model engine. An empirical rule of thumb, based on experience, is to provide an air-entry area that's equal to the area of the finned portion of the cylinder, as shown. Whether the opening is round, square, or rectangular makes no difference provided the entry has the area described.

The cooling air exit(s)' rule of thumb is that the total exit area be 140 percent of the entry area. For example: an entry area of 1.25 square inches requires an exit of 1.75 square inches for one, or 0.875 square inch each for two exits.



PHOTOS BY ANDY LENNON

The pusher nacelle on the Seagull III flying boat. The NACA inlet and the outlet below the spinner show.



The detachable portion has been removed. Note the engine accessibility and the lower cowl detail.

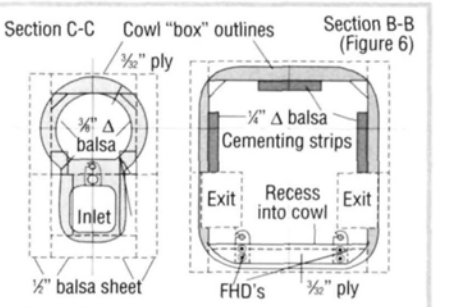
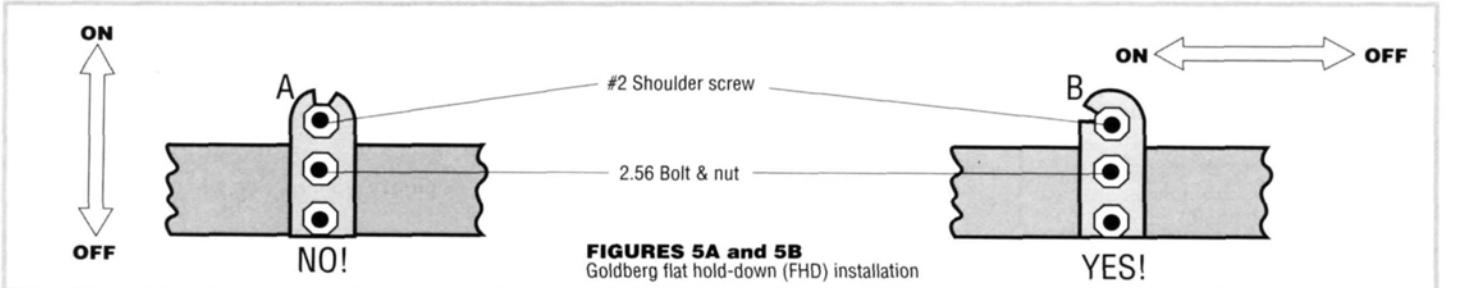


FIGURE 4
Spinner ring/entry and rear hold-down detail



FIGURES 5A and 5B
Goldberg flat hold-down (FHD) installation

ENGINE AND ENCLOSED MUFFLER

Figure 3 shows a horizontal cross-section through the Swift's cowl with a J'Tec* muffler. Both the engine and the muffler are wholly enclosed. It has an inlet, a diffuser, a cylinder and muffler, and nozzles; and the exits are at points of reduced air pressure on the fuselage sides (they look like gills on a fish!). The fuselage must be widened to accommodate the engine and muffler as in Figure 3.

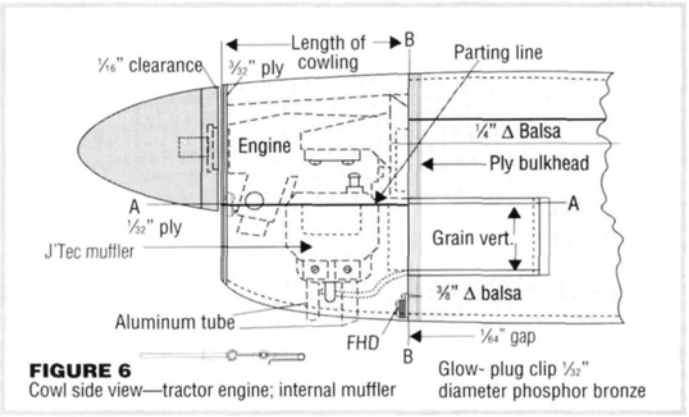


FIGURE 6
Cowl side view—tractor engine; internal muffler

The "teardrop" fuselage was described on pages 44 and 45 in *Model Airplane News*' January 1992 issue (see Figure 1, fuselage 1 and the dimensions set forth in Figure 3). This type of fuselage lends itself to a wider forward section without a drag penalty. Figures 6 and 7 detail the cowl installation.

Exhaust stacks may extend through the cowl, and the necessary holes must be elongated sideways 1/8 inch for cowl removal. They may also end just clear of the inside of the cowl with slightly larger, round holes.

ENGINE AND EXTERNAL MUFFLER

Figure 7 shows the cross-section of a cowl for an engine equipped with a stock muffler. While the muffler (and pressure tubing to the tank) is exposed, its drag is largely overcome by the jet-like exhaust gases squirting backward. With an external muffler, the fuselage may be narrower, as shown in Figure 7.

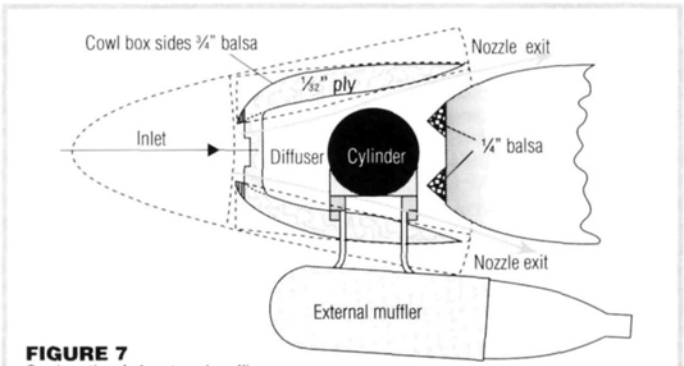


FIGURE 7
Cowl section A-A; external muffler.

COWL FASTENING

The removable portion of the cowl is held in position by three Carl Goldberg* "flat hold-downs" (FHDs). One is in the cooling air-entry former in front, and two are at the rear of the cowl (see Figures 6 and 4). All three engage no. 2 shoulder screws (supplied with the FHDs); two are screwed into the plywood engine bulkhead, and one into the plywood spinner ring.

Initially, this author used these FHDs as shown in Figure 5A. A knife blade inserted at the parting line and then twisted, detached the cowl. On smaller models, this method was satisfactory. On larger models—and after losing several detachable portions in flight (none was ever found despite lengthy searches)—it was evident that this form of cowl attachment was unsatisfactory. It was belatedly realized that the wrong end of the FHDs was being used, and the arrangement shown in Figure 5B was employed very satisfactorily—no more lost cowls!

A useful byproduct of this change was that removal requires only a sharp knuckle rap on the removable portion's side opposite the muffler. Replacement requires the alignment of the "hooks" on the FHDs with the shoulder screws and a rap on the cowl's muffler side. It is amusing to have a startled onlooker exclaim, "How did you do that!"

Part 2 will provide construction and assembly details and a cowl design for pusher engines. See you then.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

THE VERTIGO

(Continued from page 96)

unsightly, it does not detract from flight performance.

ENGINE SILENCER

Installation of tuned pipes is not feasible on this model, as presented, because of their length. (They would strike the ground with the nacelle vertical, even if you found a way to miss the control vanes.) A solution proposed for effective silencing without loss of power was put to me by Jerry Smith of Paduca, KY (see "How to Make a Mousse-Can Muffler," *Model Airplane News*, March '94 and further comment in "Airwaves," June '94). Jerry constructed a muffler package that would fit between the engine header and the roll vane. (Not an easy task!) This homemade muffler certainly reduced the noise level considerably over open exhaust, but I must admit, it is probably still in the low 100s in dB. It did not, however, rob the engine of any significant power (rpm dropped by only a couple of hundred). It did, however, improve the idle of the engine. Other homemade muffler/pipes were tried by the author, but none worked as well as Jerry's mousse can!

MAIN SPAR TUBE

The main spar tube is fabricated from a piece of ½-inch-o.d.x0.047-wall aluminum tube. The outboard end is tapped from the top (on assembly with the wing) for a 4-40 screw. (This screw retains the outboard wing panel and keeps the tube from rotating in the wing center section.) A ⅛ soft aluminum tube (the type found in gas stoves) is inserted midway down the tube and, when installed, exits at a right angle just under the fuel tank. This tube carries the fuel through the spar from the boom-mounted tank to the inside of the nacelle. Cut the ⅛ tube about 4 inches longer than the inboard end of the spar tube.

MODEL ASSEMBLY

Before beginning any assembly, make sure all the wires you will need for the servos and tilt mechanism have been installed in the wing center section and booms. Begin assembly by epoxying the booms to the wing center section. The top of the wing is flat and so is the top of each boom, so alignment should not be a problem. Glue the vertical tails into the slots in the booms, cover them, and then glue the covered horizontal tail to the verticals. The ⅛ lite-ply nose substructure can be glued to the front of the wing center section at this time. Secure the aft section of the nose pod to the substructure and wing center section.

(Continued on page 112)

SIMPLE PROGRAMMING

DAVID C. BARON

JR'S NEW XF622—A SIMPLE, INEXPENSIVE FM COMPUTER RADIO

THE JR* XF622 is aimed at modelers who are looking for their first programmable radio. With the smart collection of functions in this system, JR should introduce a lot of people to the value and capabilities of such radios. The XF622 is an FM system with six channels, two model memories and two operation modes (heli and aircraft). It costs about $250—a real breakthrough for a radio that has both aircraft and helicopter software built in. Check with your local dealer for a specific price.

SMART FUNCTIONS

Also impressive are the simplicity of this radio's programming system and the smart choice of functions. The key pad has only four buttons. Two of these get you into the programming modes, and the other two switch (on or off) or adjust (increase or decrease) numerical values. Most of the learning curve of first-time programmable-radio users is spent getting used to and understanding the abbreviations shown in the display. To ease this, JR provides an adhesive label that lists all the radio's functions and their abbreviations. I suggest that you stick it somewhere on your flight box so that you can refer to it while you're at the field (You are likely to have the manual handy if you are at home.) Don't stick it on the back of the transmitter because you'll have to keep turning the transmitter over while you're trying to work with the display and the key pad on the front of the radio. Another set of stickers is provided for the customized labeling of the switch functions. This radio is very flexible in how you can assign dual-rate switches and other mixing functions.

The system is all JR and includes a transmitter, the new NER 266X ABC & W receiver and battery pack, a system charger, a switch harness and 507 servos. Shown here are the helicopter package with five standard 507 servos and a 4.8V, 1000mAh battery pack.

The new JR XF622 is a breakthrough in the programmable-radio marketplace: it has a low price and a simplified programming system. For modelers who are looking for their first computer radio, this is a great choice.

"Quick Start" is a new section at the beginning of the manual; it gives enough information to get you flying in a hurry without using any special programming. This feature, which is so popular in the PC software industry, is truly an intelligent first in the R/C industry.

ABOUT THE TRANSMITTER

Compared with its cousins, the X-347 and the X-388S, the XF-622 has similar dimensions, but it's thinner in the grip and noticeably lighter. I prefer to fly with my thumbs, and when the adjustable stick's length and tension had been tailored to my grip, I was very pleased with the overall feel. The display screen is large for an entry-level computer system, and it contributes to the radio's value.

The receiver is the new credit-card style that is popular with JR radios. It's small and light, and the servo connectors are plugged into the end of the unit, so it fits almost anywhere.

Like the more advanced 347 and 388, the 622 uses a two-stage programming system. The first stage is entered by switching on the radio while pressing the two buttons (Mode and Channel) on the left side of the key pad. This mode allows you to manipulate the model memory, the mode (aircraft or heli), reset, copy and specific functions, such as V-tail and flaperons. The second stage is entered by pressing the same two buttons simultaneously when the radio is already on. The functions in this group are the ones most commonly used, including ATVs, servo-reversing and dual rates.

AIRCRAFT SYSTEM MODE

Model-type selection. Select "AC" for aircraft or "HE" for helicopter. *Note:* use extreme care when you modify existing

Most noticeable on the 622 transmitter's face is the reduced number of buttons on the key pad. Only four are required to program this simply designed computer radio.

David Baron flies the Kalt Enforcer ZR heli with the new JR 622 computer radio. The 622 instruction manual has much useful information on setting up a heli for the first-time pilot.

programs while you're in the system mode. If you accidentally switch from AC to HE (or HE to AC), you'll lose the programming in both the system and function modes for that particular memory.

Data reset. This returns the radio to the factory reset (default) positions for whichever memory the radio is in.

Dual-rate switch selection. This offers four position options:

- **E.A** for normal independent operation with the elevator dual rate on the left switch and the aileron dual rate on the right switch.
- **A** for operation of both the elevator and aileron dual rates on the aileron dual-rate switch.
- **E** for operation of both the elevator and aileron dual rates on the elevator dual-rate switch.
- **CF VTR** (variable trace ratio) is available on both elevator and aileron in lieu of dual rates; this feature is similar to exponential throw. In the preproduction manual that I received, the VTR explanation was a bit neglected. VTR allows you to decrease the control-throw response around the stick's center position from 50 to 100 percent.

Wing-type selection. Here, you tell your radio that your airplane has special needs. The choices are "FPR" for flaperon and "VTL" for V-tail. You can choose both if your airplane needs both functions. To use the flaperon function, you must plug your left aileron servo into the channel-6 (Aux. 1) port in your receiver and the right aileron servo into the channel-2 (Ail.) port. When using the V-tail feature, you must plug the left tail servo into the channel-3 (Elev.) receiver port and the right tail servo into the channel-4 (rudder) port.

Model selection. Choose model memory 1 or 2.

AIRCRAFT FUNCTION MODE

Servo-reversing is accomplished by pressing the "+" or "-" button for each channel.

Dual rate is adjustable for both elevator and aileron; 0 to 125 percent is available in either switch position, so you can decide whether low rates will be in the up or down switch position.

Sub-trim, or electronic trim, is used so that your manual trim levers can be centered when switching between model memories.

Travel adjustment is adjustable from 0 to 150 percent on either side of neutral. This means you can tailor your model to have equal sensitivity in each direction of control throw. For throttle adjustment, it becomes an easy task to set the high and low positions independently and precisely.

Flaperon—*note:* when using this function, setting up a neutral position for the flaps can get a little confusing because the default setting is 100 percent, and this drives your flaperon servos nearly to their limits. It's advisable to set both flap settings (up and down) to 0 percent before applying power to your airborne system.

JR has thoughtfully included a small, self-adhesive label that lists all the programming functions and their abbreviations for both aircraft and heli operation.

Aileron-to-rudder mixing is popular with pilots of large aircraft with high-lift wings. It can really contribute to coordinated turns. The function can be activated by the gear switch, the aileron dual-rate switch, or the flap switch, or it can be set so it's permanently on.

Elevator flap mixing. This popular fun-fly and aerobatic mix function slaves the flaps to the elevator. You can set the mixing value from 0 to 125 percent to modify how much throw the flaps are deflected for a given amount of elevator throw. The E/F mix function can be activated by the gear switch, the elevator dual-rate switch, or the flap switch, or it can be set so it's permanently on.

Differential can be used only after you've selected the flaperon function in the system mode. This function is most commonly used to correct adverse yaw in turns by allowing more upward than downward aileron throw.

Flap-to-elevator offset trim is used to correct the pitch-trim change (up or down) that's exhibited by some aircraft when the flaps are deployed. This is accomplished by re-trimming the elevator position.

HELICOPTER SYSTEM MODE

The model-type selection, data reset, dual-rate switch selection and model selection functions work in the same way for both aircraft and heli system modes. Added to the heli system mode are the special functions required for helicopter flight, including gyro switch selection, which offers four position options:

- **H** for the hold switch position (at the top right of the transmitter).
- **A** for the aileron dual-rate switch position.
- **E** for the elevator dual-rate switch position.
- **F** for the flight-mode switch (at the top left of the transmitter).

Aileron-to-rudder mixing is popular with pilots of large-scale models with high-lift-producing wings. The mix makes coordinated turns much easier to do and greatly reduces yaw problems.

Here's the screen display for the dual-rate switch selection function. "E.A" represents normal independent switch operation with the elevator dual rate on the left switch and the aileron dual rate on the right.

HELI FUNCTION MODE

Servo-reversing, dual rates, sub-trim and travel adjustment are the same as those for the aircraft mode.

Throttle hold. This function is most often used to practice autorotations. It allows you to preset the throttle to an idle and to further custom-tailor a special pitch curve to maximize your helicopter's descent. Commonly, a high-end pitch point of 12 degrees is used to squeeze every last bit of lift out of the rotors if it's needed. On the low side, you'd want to set a negative pitch value that will keep the rotor head spinning at hover rpm without using so much that the helicopter plummets; -3 degrees is a common low-end setting to start with. You'll have to try this value in flight to find out whether more or less pitch is needed.

When throttle hold is activated, two other things happen:

1. The pitch-curve function opens another set of values under the abbreviations "PLH," "P2H" and "PHH" (see pitch-curve explanation below).
2. Another function is added to the revolution-mix function. It's abbreviation is logically "HLD." This feature allows you to take out the torque compensation that the helicopter normally needs when the engine is driving the blades (see revolution-mix explanation below).

Pitch curve. This radio has three pitch curves: the normal range, the stunt range and the throttle hold (or autorotation) settings. You switch from one curve to the other when you switch the flight-mode switch. The throttle hold is activated by the hold switch. All of the curves can be manipulated in the low, center and high stick positions.

Although the reason for manipulating the extremes is obvious, the reason for the center stick adjustment is to bring the stick to the desired position for the mode in which you're flying. For instance, in the normal (or hover) mode, you want the throttle stick to be close to the center when the helicopter is hovering. In stunt position, you want the stick's middle position to be closer to 0 degrees of pitch. This way, you have the leeway to hover and climb whether you're flying right side up or inverted. Position 2 in all the pitch curves lets you adjust this value. (Note that the back of the heli section in the XF622's manual gives some sound advice for first-time helicopter users on setting up your radio.)

Throttle curve. This is where you match your engine's power to the pitch curves that your helicopter and your flying abilities require. You switch from one curve to the other when you use the flight-mode switch. They're similar in adjustment style to the pitch-curve system. In the stunt mode, it's normal to have the low throttle-stick position at a high engine rpm value so that you're powering the rotor system through switchless inverted maneuvers. Also in stunt, your middle throttle position should be close to 0 degrees of rotor pitch, so the power setting will maintain normal rotor-head speed during the maneuver. The only way to determine that this power setting is correct (before you gain flight experience) is to use a tachometer with the heli anchored to a table or stand. *Note:* as long as your engine has enough power, adjust the engine rpm so you have the rotor-head pitch angle required to maintain rotor rpm; don't adjust the pitch angle to run the engine at a certain rpm.

Revolution mix. This function allows you to compensate for the engine's torque. There are two basic settings—up and down. The "up" value lets you compensate for the increasing torque loads placed on the helicopter by the engine as you advance the throttle above the halfway (hover) throttle-stick position. The "down" value compensates for the decreasing torque load placed on the helicopter when it's descending under power and the throttle is below the half stick position.

Rudder offset. This is the last point to adjust in this mode. This is a function of your throttle-hold system. When the throttle-hold switch is activated, the revolution-mix settings are replaced with the offset value. This is because all of the torque loads on the helicopter vanish when the throttle is cut to idle (simulating a dead engine). The offset value should be whichever setting is required to give you 0 degrees of tail-rotor pitch.

(Continued on page 112)

THE GREAT

R/C SLOW-FLIGHT DESIGN CONTEST

Co-sponsored by MODEL AIRPLANE NEWS, NASA Langley Research Center, the NACA/NASA Alumni Assoc. and Shapery Gyronautics Corp.

CASH PRIZES IN THREE CLASSES!

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Designed to spur development of practical low-speed flight capability—slow-flight performance and innovative design.

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Contest runs from January 1, 1994 to December 31, 1994.

Entries evaluated by committee of NACA alumni and NASA design engineers.

Awards presented in early 1995 at Virginia Air and Space Center in Hampton, VA.

■ **Class A**—Wing loadings of 15 oz. per sq. ft or less.
■ **Class B**—Wing loadings of 20 oz. per sq. ft. or more.
Classes A and B must have total displacement of between .40 and .50ci, irrespective of the number of engines. Additional electric propulsion is allowed. Slow-flight time trials will be held outdoors along a 100-foot strip no more than 20 feet wide.
■ **Class C**—Must be powered by electric motors running on commercially available Ni-Cd batteries; must fly at least twice around perimeter of regulation-size (professional) indoor basketball court on one charge and do a figure-8 within the court (not necessarily on same run as the laps). Slow flight will be measured separately along a 15-foot wide, 50-foot course.

BE PREPARED!
■ *Entrants will provide:* three-view; aircraft specs. (including a statement of performance); description of design (two typed pages, or less); still photos of aircraft; letter signed by CD and local club president; videotape of flight tests. Flight tests will be conducted locally by R/C clubs under the honor system and under applicable AMA safety guidelines.
■ *Winners will submit (and will be paid separately for):* construction article, including workable draft of full-size plans, black-and-white construction photos, construction steps, color slides of the model on ground and airborne.
■ For rules, contact Julie Soriano, Managing Editor, *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. Have specific questions? Contact Tom Atwood at (203) 834-2900; fax (203) 762-9803; Internet: toma@airage.com.

We hope this inspires you!

THE VERTIGO

(Continued from page 104)

Glue the stiffener ring (F1) to the forward nose section, and add the retaining "keyhole" screws. Hold the fan assembly in place, and insert the spar tube into the booms and center section passing into the nacelle pivot blocks. Check for smooth, slop-free rotation. Ream the nacelle pivot hole slightly if it's too tight. If it's too sloppy, soak the wood with CA, and ream it smooth. Goes together easily, doesn't it! Install the fuel tanks below the spars in the booms. Install the radio, check that the CG is on the tube/spar and that the model balances left to right.

Next month, I will discuss the successes *and failures* of this and some of the other models that got me to this point—so you won't be tempted to repeat my (our?) mistakes. I will also discuss the flight test plan I feel it is necessary to follow to successfully trim and fly the model.

For this month, I hope that this article has introduced you to the possibility of building and flying your own VTOL model. Since this is a very young technology (to R/C modelers), I encourage anyone who has already attempted something like this to write to me, care of this magazine (251 Danbury Rd., Wilton, CT 06897; internet toma@airage.com), as any knowledge (success or failure) is welcome to further advance this (new?) part of the hobby! See ya next month for the conclusion (or the end of the beginning?).

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

SIMPLE PROGRAMMING

(Continued from page 110)

PROS AND CONS

The XF622 is truly a remarkable value for t money. For a cost-saving feature, JR decid not to include independent mixing functio that are found on the X-347 and X-388S.

I'm very impressed with the instructi manual's excellent layout. Each item explained with a good mixture of *what* t function is used for and *how* it's set up. I li this style!

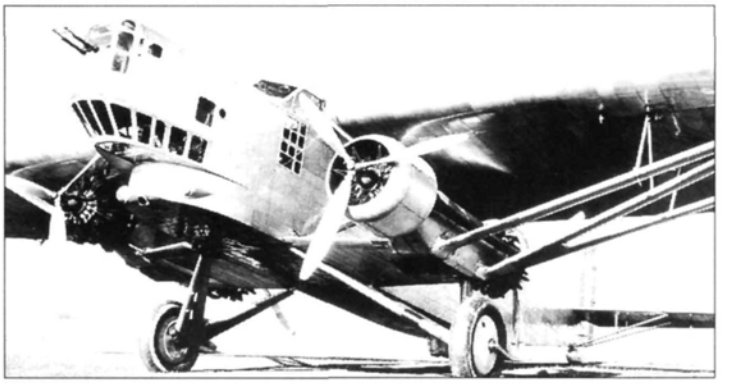
Something new that I had to get used was that the program buttons are flush, and t lack of "feel" left me frustrated when the rad didn't respond to my touch. When you press traditional button, you can at least feel it a hear a "click." The new sealed buttons d however, prevent dirt and dust from gettir into the key pad.

(Continued on page 1

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.



CONGRATULATIONS to David Jones of Evanston, IL, for correctly identifying the May mystery plane. The Junkers Ju. 46 was a special version of the W. 34, outfitted for catapult launches off ocean liners. This type of aircraft was used by the German Lloyd steamships, the Bremen and the Europa.

COURTESY OF MR. B.F. KIMMEL

The Junkers W. 34/Ju. 46 was powered by a BMW Hornet C radial engine—an exact copy of the Pratt & Whitney Hornet 600hp, 9-cylinder engine—that was built under license from the Pratt & Whitney Aircraft Co. The aircraft had a max speed of 139mph and a cruise speed of 118mph. It was 34 feet long and had a wingspan of 58 feet, 3 inches. The Ju. 46's cockpit could accommodate two pilots, side by side, with dual controls, and there were four to six seats in the cabin. As a freighter, the aircraft had room for 176.6 cubic feet of cargo, which was loaded through a large door on the left side. Its service ceiling was 15,400 feet, and it had a range of 490 miles.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

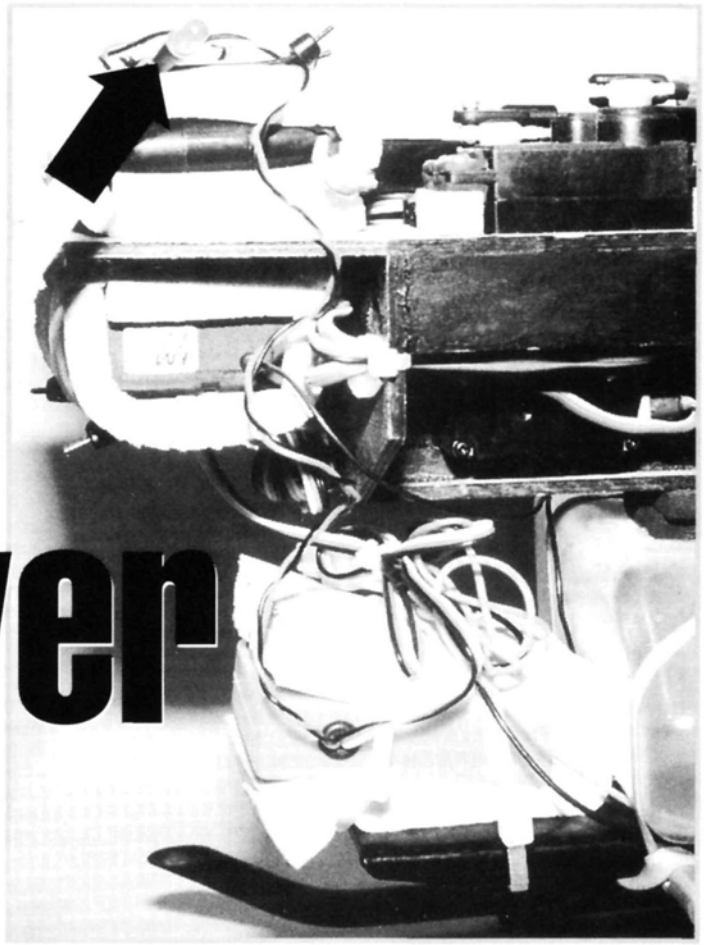
PRODUCT REVIEW

McDaniel On-Board Glow Driver

No 466

by A. E. STANLEY Jr.

Simple insurance for easy starts and reliable idles



Here's the glow driver installed in my helicopter. It's compact and works exactly as its manufacturer says it will. The arrow shows the red LED indicator at the top. All you have to add is your own servo lead. The unit is very easy to set up and operate.

LIKE MOST OF the products that the folks at McDaniel R/C* put out, my glow-starter kit arrived in a small, plain, simply labeled white box. I like this approach, because it seems that more thought goes into the product than into fancy packaging. The glow driver was very well-packed and well-protected for shipping.

SPECIFICATIONS

Product: On-Board Glow Driver (no. 466)

Manufacturer: McDaniel R/C Inc.

Dimensions: 2.25x2.25x0.50 in.

Weight: 3 oz.

Working voltage: 1.2 volts (two, AA, 1300mA Ni-Cds included with charger)

List price: $89.95

I checked the contents of the box against the parts list and the directions. Everything was there, so I started assembly. Other than the unit itself, the only thing that's needed is a servo lead to suit your particular radio. To prepare the unit for installation in a helicopter, you'll have to solder on the servo lead and a few other wires.

INSTALLATION

First, I installed a servo lead for my Futaba* 7UHP radio system. I had already charged the unit overnight (a 12-hour charge is advised), so I was ready to hook the unit up and try it out. The only other electrical work to be done was to connect a Molex connector to the glow plug and ground wires. This is a male/female system, so take care to get the correct ends installed.

Having wired the unit, I wrapped it in foam to protect it from vibration (do this with any electronics) and then installed it in my helicopter. You can use the unit in two ways:

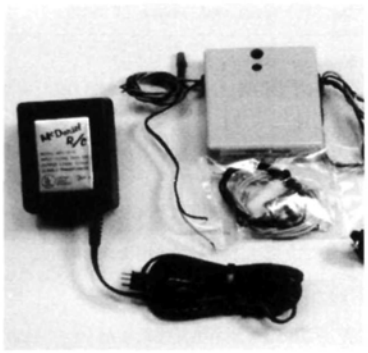
- Simply plug it into an unused channel, and use a switch to turn the glow plug on and off.
- Wire the driver to the throttle servo, and control it with the throttle channel. To do this, you'll need a Y-harness. Simply remove the throttle servo from the receiver, and plug the Y-harness into the throttle port. Plug the throttle servo into one half of the Y-harness and the glow driver into the other half. You're now ready to set up the unit. With the glow driver installed, turn on the radio to make sure that the servo is operating in the correct direction.

SETTING UP

To set up the parallel throttle-servo system, you first put the throttle stick to the low position and the trim lever to the high position. At this point, the variable resistor on the control unit is adjusted until the red LED comes on. This tells you that the glow driver is on and that voltage is being supplied to the plug. Moving the throttle stick up from this position will turn the glow driver off.

The LED that comes on when the unit is operating is very convenient; you can tell at a glance

whether the glow driver is turned on or off. This light also lets you know whether the glow plug has a bad coil; it won't light up if it does.



This is how the McDaniel On-Board Glow Driver comes out of the box. Like most McDaniel units, it's of the highest quality. You can connect the unit to a separate channel, or to the throttle channel (with a Y-harness).

The unit is very well-constructed and easy to install and use. I set it up in both configurations, and both worked as the instructions said they should. Overall, I think it's best to connect the unit to the throttle servo with a Y-harness, but this system can quickly run down the battery in the unit. On a full charge, the unit has an average run time of 20 minutes—not continuous, but spread over time.

As well as its obvious use in scale helicopters, in which installing a glow driver is sometimes a problem, this unit has many other applications. Use it in a machine that has a hard time maintaining a good engine idle. I found that it worked very well in a Concept whose engine, which is mounted upside-down, does not like to sit at idle for any time. Keeping the glow plug lit greatly helps this machine.

The McDaniel On-Board Glow Driver is very well-made and does everything its manufacturer claims it will do. It's compact and supplies its own power, so it would be a welcome addition to any scale machine and very handy for pod-and-boom fliers, too. With the unit on board and ready to go, engine starting is easy and idle is much improved. Happy flying!

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

CLASSIFIEDS

RATES: non-commercial—25 cents per word. No charge for name and address (no commercial ads of any kind accepted at this rate); commercial— 50 cents per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. **All ads must be paid for in advance.**

To run your ad for more than one month, multiply your payment by the number of months you want it to run. Deadline: the 10th day of the month, 3 months in advance, e.g., *January 10 for the April issue.* We don't furnish box numbers, and it isn't our policy to send tear sheets. **SEND AD AND PAYMENT TO: CLASSIFIED ADS, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.**

R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE: 100 pages–timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [8/94]

HELICOPTER SCHOOL—five days of hands-on instruction with X-Cell helicopters and Futuba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 350 satisfied students and 3,000 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (800) 452-1677. Outside USA: (904) 698-4275, or fax (904) 698-4724. [9/94]

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). Specify needs. Send SASE and 60 cents for list. Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

CUSTOM KIT BUILDING. Will build most kits from trainers to 1/4 scale; 20 years experience. Write for quotes: Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [8/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [11/94]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [11/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [11/94]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [11/94]

ARE YOU TIRED OF PAYING $1.29 for six screws? For a *free* catalogue and price list of screws, nuts, locknuts, blind nuts and more, in sizes from 0-80 to 1/4 inch, contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (800) 892-6917; fax (908) 788-2607. [11/94]

MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [9/94]

ANTIQUE IGNITION engine parts: excellent reproductions, fuel tanks, points, timers, coils, needle valves, gaskets, etc. Champion spark plugs. Catalogue—$5 (intl. airmail—$7). Aero-Electric, 1301 W. Lafayette St., Sturgis, MI 49091. [8/94]

WANTED: ignition model engines 1930s to 1950s, especially Elf, Baby Cyclone, Brown Jr., Ohlsson Custom and Gold Seal. Also model racecars, any parts, spark plugs, etc.; Woody Bartelt, 1301 W. Lafayette St., Sturgis, MI 49091; (616) 665-9693, or (800) 982-5464. [8/94]

LOCKHEED P-38 LIGHTNING. If P-38s—R/C scale models or full size—are your *thing*, join the P-38 Model Organization International—a worldwide association for P-38 enthusiasts. For more information, send $1 to P-38 M.O.I. Medelbyvej 54 DK 2610 Rodovre, Copenhagen, Denmark.

SCALE DOCUMENTATION and resource guide. Larger, updated 1994 Edition. World's largest commercial aircraft collection. Over 5,000 different color FOTO-PAAKS and 25,000 three-view drawings; 152-page resource guide/catalogue—$6 (Canada—$7; foreign—$12). Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [8/94]

INTERNATIONAL AIRCRAFT RESEARCH: need documentation? Include name of aircraft for availability of documentation, with $3 for photo and three-view catalogue. 1447 Helm Ct., Mississauga, Ontario, Canada L5J 3G3. [9/94]

MAGAZINE BACK ISSUES—*Flying Aces, Model Airplane News, Air Trails,* 1930s and '40s. FM, RCM and more. Send SASE for list to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [9/94]

PAYING $50 each for toy metal outboard boat motors—Mercury, Evinrude, Gale, Oliver, Scott, Johnson. Ship for immediate payment, or call (616) 941-2111; Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684. [8/94]

SMOOSHIE BAILS OUT! Release a scale-like parachutist!—a real crowd pleaser and a lot of fun! For a brochure, send SASE to Hobby Hut Mfg., 2040 W. 21st. N., Ste. 77, Wichita, KS 67203-2107 (Dept MAN). [10/94]

GERMAN AIRCRAFT WW II—handbooks, service part lists, instruction manuals. List—$2. Udo E Hafner, Eugen-Bolz-Str. 15, D-71636 Ludwigsburg, Germany. [11/94]

KIT CUTTING—Will custom-cut any kit to your specifications. Your plans or mine—*guaranteed* quality like none other. Call or write: 43940 Yorktown, Canton, MI 48188; (313) 697-6804. [8/94]

HELP! I need the following toy metal outboard boat motors: *Oliver*, Gale Sovereign, Buccaneer, *Evinrude* Lark, Starflite, *Mercury* Mark 55,75,78,1000, *Scott-Atwater, Johnson* 40, 75, *Sea-Fury* 2-cylinder. Paying $75 to $100 each. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684; (616) 941-2111. [8/94]

R/C PRODUCTS: CA Tip Extender—6 for $1 (2- and 4-inch). Discounted kits, balsa, ply, hardware, etc. Catalogue—$2. Shoreham Model Airplanes, P.O. Box 794, Shoreham, NY 11786. [8/94]

WW I PLANS—Peanut to 100 inches. Send $2 for illustrated catalogue to Clark Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [3/95]

CASH FOR ENGINES: ignition, glow, diesel—all types; any condition; sale list, too! Estates my specialty! Send SASE for list: Bob Boumstein, 2811 S. 165th Ave., Omaha, NE 68130; (402) 334-0122. [8/94]

ONE-INCH BELT SANDER. Build yours for less than $20. No special tools required. Send $7 for Crafty Creations, Box 222, Burlington, KS 66839. [8/94]

BOOKS! "Tailless Tale"—tailless aircraft for modelers; $38. "Structural Dimensioning of Radioguided Aeromodels"—building strong and light; $18. "On the Wing...the book"—tailless R/C sailplanes; $28. Orders or information: B2 Streamlines, Dept. A, P.O. Box 976, Olalla, WA 98359. [9/94]

HISTORIC REPLICAS: Flying Tigers, 94th Aero, Lafayette Escadrille Accessories, Pilot Sport Shirts, T-Shirts, Wings, Pins, Medals, Beer Steins, Scarves. Free gift with order; catalogue $1, refundable. Company of Eagles, 875A Island Dr., Ste. 322N, Alameda, CA 94502. [9/94]

DO YOU SPEAK MODEL AIRPLANE? Seventy years of aeromodeling history! All the heroes, contests, models! Paperback, 320 pages, $19.95 postpaid. Also: Old Buzzard's Soaring Book, $16.95. Dave Thornburg, 5 Monticello, Albuquerque, NM 87123; (505) 299-8749 for Visa/MC. [10/94]

FLY DAVE BROWN SIMULATOR. Use your transmitter. Works with Futaba, JR, Airtronics, Hitec. Uses standard joystick connection. For more info, contact Computer Designs, 8530 N. Montana Ave., Helena, MT 58601; (406) 458-9416. [9/94]

OLD MODEL MAGAZINES. SASE for list. Dave Bessel, P.O. Box 669, Poway, CA 92074.

NEW ZEALAND AERO PRODUCTS. Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Epoxy fiberglass parts, hardware packs, timber packs, color photo packs available. Free documentation with plans. Fiberglass kit sets: P-51D Mustang, PBY Catalina, Focke Wulf 190, Bushby Midget Mustang. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand. Phone/fax-032128192.

I BUY G.I. JOE. I fly R/C and collect G.I. Joe. If you have any to part with, call or write with description and price. Jeff Gilbert, 130 N. Vernon St., Princeton, IL 61356; (815) 875-4611. [8/94]

MOLD-MAKING/CASTING GUIDEBOOKS. Complete techniques and sources for rubbers, plastics, resins, metals and more. Further information: Castech-A7, Box 16586, Memphis, TN 38186-0586. [9/94]

ENGINES FOR SALE: new, used, early and late glows. Some with carbs and mufflers. SASE for list. Joel Balsam, 4 Pickwick Hill Dr., Huntington Station, New York, NY 11746-1241. [9/94]

R/C SWAPMEET IN YOUR LIVING ROOM! Nationwide buy/sell/trade newsletter with fast circulation. Free sample copy. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521. [8/94]

AT-6 AND B-17 HOBBY INFO BOOKLETS: 52 pages of detailed drawings and photos from original WW II service manuals—$14.95 plus $3 S&H. Complete manuals, 500+ pages—$79.95 plus $6 S&H. Specify model. Masterworks, 3806 Pinemont, Houston, TX 77018. [8/94]

JET ENGINES—pulsejets, Jet-X, Turbonique. Monthly newsletter $17/yr; $25 international; single issue $2. Catalogue $5. DOYLEJET, P.O. Box 60311-A, Houston, TX 77205; (713) 443-3409. [8/94]

PIT-SAFE SERVO DRIVER—Three models to choose from. Perfect for field or bench servo set-up. Servo reverse/retract switch standard. Starting at $18.95. For more info., write: Bouk R/C, 25089 Jutland Dr., Hemet, CA 92544. [9/94]

FIELD BOX WITH EVERYTHING for the field—$75; box of goodies—iron, test stand, etc.—$75; Flight Star 40 in box w/engine .40—$125; Road Trainer w/engine .40—$50; Contender .40 w/engine—$50; 4-channel radio w/charger and batteries—$50; (212) 942-9277. [8/94]

by JEF RASKIN

MVVS HOTS

Subject: the Profile Hots airplane with the MVVS .40 engine.
Source: Morris Hobbies, 169 Eastern Pkwy., Ste. 1237, Louisville, KY 40217; (800) 826-6054 or (502) 451-0901.
Summary: radically incredible fun-style aerobatics; extended hovering; a blast.
List price: $10 (plus $2 S&H)
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: 40 minutes.

My fingers were twitching the whole time I watched this video; this is one hot plane, and I wanted to be at the sticks. Picture this: the model is held vertical, as if you were checking the fuel draw. Now the plane slowly lifts—like the space shuttle—accelerating upward. The skilled pilot (in this case, Tony Ayer) stops the plane dead in the air and hovers as still as a hawk watching a mouse. Then, the plane descends straight down gently, touches the tail wheel to the ground, with its nose still pointed skyward, hesitates a few seconds and ascends vertically—a one-point touch-and-go.

Most of the landings on this tape are done vertically, with the plane slowly pivoting on its tail wheel to rest on its main gear. This is beyond aerobatics; the problems of hovering flight, transition-to-horizontal (upright or inverted, who cares!) flight and back and anything else you care to mention have been solved. And simply.

The Profile Hots can be flown conventionally, if you call a flat spin to a landing and rolling circles conventional. The jack-in-the-box takeoff is impressive: you hear a model engine in a cardboard box, and the plane rises like a phoenix through its own smoke. It's a triumph of power and daring over gravity and sanity. My only quibble is that no ear protection is used by the pilot, and his eyes and face are protected by nothing more than sunglasses as he stands in the propeller's arc while adjusting the engine. The MVVS .40 seems to go from idle to more than 15,000rpm—and back, repeatedly—without missing a beat.

The tape has the best music ever: the singing of a well-tuned engine. This is a homemade video; it's a bit repetitive and doesn't have titles, talk, or editing. But all that doesn't matter. You've got to see how this airplane flies! Warning: you're likely to make your next phone call to Morris Hobbies and buy one. (Prices—$59.95 for the plane; $189.95 with motor and muffler.)

DREAM IT, BUILD IT, FLY IT!

Subject: the Kitfox (full-size) homebuilt airplane.
Source: Skystar Aircraft Corp., 100 N. Kings Rd., Nampa, ID 83687; (208) 466-1711; fax (208) 466-8703.
Summary: an infomercial about the best-selling kitplane.
List prices: $15 (info pack); $15 (videotape); $25 (both).
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: 35 minutes.

One-to-one is the favorite scale of people who want to fly in the models they build and, of all the kit-built planes, the Kitfox is *numero uno* in sales. My pilot friends tell me that it's as fine as this video makes it out to be. Unfortunately, the tape does not cover what I think might be of greatest interest to modelers, namely, how you build one, but there are plenty of shots of the structure and a bit about how they assemble kit elements at the factory.

The tape is entertaining to watch as a Kitfox Speedster does some dramatic aerobatics (in the capable hands of a professional air-show pilot). There are many short-field takeoffs and landings

(Continued on page 129)

SIMPLE PROGRAMMING

(Continued from page 112)

The XF622 is an economical and very well-designed programmable radio aimed at modelers who have conventional 4- to 6-channel systems. With the XF622, moving up to a programmable system won't break your budget.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ■

VIDEO VIEWS

(Continued from page 119)

on paved and unpaved surfaces using wheels, floats and skis. The planes are shown flying over some beautiful country. For a kit, the plane offers surprising sophistication in instrumentation and options, including a set of floats with retracting wheels. I was surprised to learn that the planes can carry a 600-pound load and that one model has vacuum gyros and a 600-mile range for serious cross-country flying.

Although it isn't aimed at modelers, those who dream of building something that can be controlled from the inside or who are considering modeling a Kitfox will find it enjoyable. The air-to-air photography ranges from very good to spectacular, and the sales pitch is soft-pedalled. ■

PRODUCT NEWS

BOB VIOLETT MODELS
F-80 Shooting Star

This Korean War vintage jet has a conventional, straight-wing planform. A generous dihedral and scale washout in the wing add to its inherent stability. The kit includes a Vio-coated epoxy/glass fuselage, and the hatches and ducts are reinforced with Kevlar and carbon fiber. The wings and tail are preformed in molds and come with attached balsa skins. Power is supplied by the Viojett with a BVM 81, 91, or O.S. 91 installed.

Introductory price—$895 ($25 S&H).

Bob Violett Models, 170 State Rd. 419, Winter Springs, FL 32708; (407) 327-6333; fax (407) 327-5020.

SCALE MODEL RESEARCH
Catalogue and Resource Guide

Bob Banka's 152-page Scale Documentation and Resource Guide lists 5,000 Foto-Paaks and 22,000 three-view drawings and includes 13 scale-related articles written by some of the top competitors and authorities in the scale movement. The Foto-Paaks are 3½x5-inch, full-color photos that show details such as paint schemes, markings, instruments and landing gear.

Prices—$6 ($7—Canada; $12—abroad).

Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058.

MIDWEST PRODUCTS
Malibu .40

This basic trainer kit features tab-lock fuselage construction with a removable hatch for easy fuel-tank access; an interlocking wing that uses pre-shaped, notched, leading and trailing edges; and a flat-bottom airfoil. The Malibu .40 can be built as a tricycle gear or a tail-dragger. All hardware is included. Specifications: wingspan—60¾ inches; wing area—730 square inches; flying weight—5 to 6 pounds; engine—.32 to .46 2-stroke, .40 to .50 4-stroke; radio—4-channel.

Kit no.—179; **price**—$94.95.

Midwest Products Co. Inc., 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342; (219) 942-1134.

TYLER INDUSTRIES
The Stuph

This unique formula stops rust and corrosion on contact, and it will prevent them from starting. The Stuph is also a pressure lubricant and a penetrant, and it will displace moisture for up to six months. It won't harm any plastics or coatings, and it can be reapplied easily.

Prices—$15/3.5-ounce, non-aerosol, refillable container; $39.95/16-ounce refill.

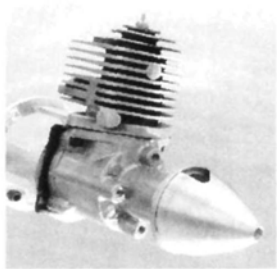
Tyler Industries, P.O. Box 1595, Wallingford, CT 06492; (203) 284-8311; fax (203) 294-1720.

PROCTOR ENTERPRISES
Fokker EIII Eindecker

This ¼-scale vintage kit includes four sheets of plans; longerons made out of maple dowels; preformed, ready-to-assemble reed wingtips and control surfaces; rigging and control cables; control horns; wing fittings; operable turnbuckles; a spun-aluminum cowl; and wheels. Specifications: wingspan—100 inches; length—70 inches; weight—15 to 20 pounds; wing area—1,655 square inches; engine—1.6ci or larger.

Kit no.—1800; **price**—$429.95 (plus $15 S&H).

Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002; (503) 678-1300.



JAG LTD.
Jaguar Glow Engine

Jag Ltd. introduces its new 3100 series Jaguar glow engine. It weighs only 37 ounces with the supplied custom mount. The 1.86ci engine can swing a 22x10 prop at 5,000rpm and smaller props at more than 8,000rpm. The Jaguar has dual ball bearings and needle-rod bearings, a hard-chromed cylinder bore and a pinned piston ring for easy starting and a big-bore rear-intake carburetor. A muffler is included; headers will be available.

Price—$299.95 (special introductory price—$229.95).

Jag Ltd., 7805 SVL, Victorville, CA 92392; (619) 243-6930.

PRODUCT NEWS

ACE R/C
Smart Throttle

This throttle is safe and requires no adjustments; you only need a servo connector to make it compatible with your system. Each time the device is switched on, it reads the position of your throttle stick as "off"; you can't accidentally switch on with the throttle advanced. It works with one to 26 cells at more than 35 amps. It weighs only 1 ounce, is less than 1/2 inch thick and comes with 14-gauge silicone battery/motor wire (connectors aren't included).

Part no.—22K50C; **price**—$59.95.

Ace R/C, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037-0472; (816) 584-7121.

CARLSON ENGINE IMPORTS
AME .049 Glow Engine

This AME .049 contest engine is rated at 0.237b.hp (175 watts) at 25,000rpm. It has a front intake, side exhaust, Schnuerle porting and beam mounting. It features a large "bathtub venturi" and is designed to run on pressurized fuel. Specifications: bore—10.2mm; stroke—9.6mm; displacement—0.048ci; weight—1.4 ounces (including the supplied spinner).

Price—$50 (plus $4 S&H).

Carlson Engine Imports, 814 E. Marconi Ave., Phoenix, AZ 85022-3112; (602) 863-1684.

ZIMPRESSIONS
T-shirt and Sweatshirt

This bright, five-color design will turn heads at your flying field or club meeting. "Model Aircraft Crash Test Team" and "R.C. Modeling Is Just 'Plane' Fun!" are printed on ash-gray Fruit of the Loom™ T-shirts and sweatshirts. They're available in adult sizes large, XL and XXL.

Prices—$10 (T-shirt); $17 (sweatshirt); add $1.50 for each XXL size; add $2 S&H. Iowa residents, add 5-percent sales tax.

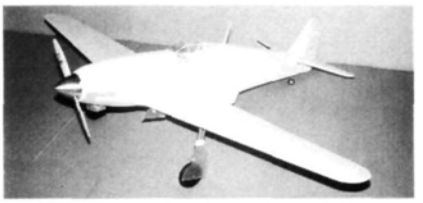
Zimpressions, P.O. Box 13345, Des Moines, IA 50310; (515) 255-1593.

HOBBICO
Lead-Calcium Receiver Battery

This sealed, lead-calcium 6V, 1300mAh battery is rechargeable and maintenance-free. Compared with standard 4.8V receiver Ni-Cds, this pack can safely increase servo speed and torque by approximately 20 percent. Compatible Hobbico Command Servo battery leads are available for Futaba J, Airtronics and JR/Hitec. Specifications: dimensions—2x3.8x1 inches; weight—9.9 ounces; maximum discharge current—40Ah.

Part no.—HCAP0780; **price**—$19.99.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.



MADDEN MODEL PRODUCTS
Kawasaki KI-61-1 Hien

This 1/6-scale, all-wood kit, designed by Don Smith Plans, includes formers, ribs and parts. The plans (sold separately) include five sheets of drawings and two sheets of full-size, scale-view drawings. Specifications: wingspan—86 inches; weight—16 to 19 pounds; engine—SuperTigre 2500 2-stroke.

Prices—$270 (kit; $5 S&H); $52 (plans).

Madden Model Products, 255A Horicon Ave., Brant Lake, NY 12815; (518) 494-7408. Order plans and accessories directly from Don Smith, 219 Goolsby Blvd., Deerfield Beach, FL 33442; (305) 570-7551.

LINCK MODELS
Super Doubler II

This all-wood, sport, aerobatic kit is light and ready to assemble. It comes with an accessory package of Du-Bro and Sig hardware, i.e., bellcranks, hinges, control horns, 5/32 pre-bent landing-gear wire, wheel-pant mounting brackets and a clear plastic canopy. Specifications: wingspan—51 inches; wing area—517 square inches; engine—.45 to .53 4-stroke, sport .40 2-stroke; radio—4-channel.

Price—$84.95 (plus $4.50 S&H).

Linck Models, 141 Moulton Hill Rd., Monson, MA 01057; (413) 267-9545.

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News** nor guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News. Manufacturers!** To have your products featured here, address the press releases to **Model Airplane News**, attention: Julie Soriano.

CLUB OF THE MONTH

AJAX R/C MODEL CLUB

c/o Jim McIntyre, 1655 Pickering Pkwy., # 507 Pickering, Ontario, Canada L1V 6L3

This month, our pick goes to a club that's just north of us—the Ajax R/C Model Club. In their March '94 newsletter, *Tarmac*, club president John Brunke introduces the club's newly elected editor, Jim McIntyre. Given that this is his first issue, Jim seems to be doing a fine job; keep up the good work!

The newsletter starts with field-safety tips to which *all* modelers should adhere, and they emphasize that spectators and children should be kept behind the fence and away from the pit area. A maximum noise level is also enforced; any airplane exceeding 97dB at 3 meters isn't allowed to fly.

Jim encourages members' involvement by asking them to submit articles—particularly articles for beginners—for publication in the newsletter, and he enlists their help in coordinating events such as the Scale Rally on June 4. The club also has "Show and Tell" and other programs at their meetings.

The newsletter features a "Coming Events" calendar that lists six months' worth of pylon, fun-fly and pattern contests. There's also a section for letters, and the newsletter is replete with a variety of ads.

This club is active in its community. Several members sold tickets to benefit the Canadian Cancer Society, and to promote the sport, the club puts on an annual static show at a nearby mall.

This past winter, the club held a Frozen Finger Fun Fly. Two eager souls—Clive Thomas and Paul Sanita—braved the cold, and half a dozen spectators encouraged them from the sidelines. We admire your devotion to the sport!

Congratulations to the Ajax R/C Model Club for being our "Club of the Month!" Your two complimentary subscriptions to *Model Airplane News* are on their way. ■

INDEX OF MANUFACTURERS

21st Century Paint; *distributed by Coverite, 420 Babylon Rd., Horsham, PA 19044.*

Anabatic Products, *411 Beach Park Blvd., Foster City, CA 94404; (800) 573-9373.*

AstroFlight Inc., *13311 Beach Ave., Marina Del Rey, CA 90292.*

Balsa USA, *P.O. Box 164, Marinette, WI 54143.*

Bob Violett Models (BVM), *170 State Rd. 419, Winter Springs, FL 32708.*

Bull's-Eyes, *2956 Kelly Rd, La Crescent, MN 55947.*

Cannon R/C, *2828 Cochran St., Ste. 281, Simi Valley, CA 93065.*

Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*

Cirrus Ventures, *115 Hunter Ave., Fanwood, NJ 07023; (908) 322-7221.*

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Dave Brown Products, *4560 Layhigh Rd., Hamilton, OH 45013.*

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DeltaComm Development, *P.O. Box 1185, Carey, NC 27512; (919) 660-4556 (voice); (919) 460-4531 (BBS: testing, tech support and program downloads).*

Direct Connection R/C, *562 W. Schrock Rd., Westerville, OH 43081; (800) 593-5250.*

Don Smith Plans, *2260 N. Dixie Hwy., Boca Raton, FL 33431.*

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GEnie, *General Electric Co., P.O. Box 6403, Rockville, MD 20849-6403; (800) 638-9636.*

GEnie Hobbies RoundTable, *Paul Arildsen, Sysop (System Operator); GEnie mail address: PAUL.*

Global Hobby Distributors, *18480 Bandilier Cir., Fountain Valley, CA 92728; (714) 964-0827.*

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Kyosho/Great Planes Model Distributors *(see address above).*

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Madden Model Products, *255A Horicon Ave., Brant Lake, NY 12815; (518) 494-7408.*

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Slegers Intl., *Rte. 15 Wharton, NJ 07885; (201) 366-0880.*

Sullivan Products, *P.O. Box 5166, Baltimore, MD 21224.*

Sundance Model Products, *2427 W. Adrian St., Newbury Park, CA 91320; (805) 498-8857.*

Weston Aerodesign Co. (WACO), *944 Placid Ct., Arnold, MD 21012; (410) 974-0968; fax (410) 974-8580.*

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